# PUBLIC WORKS

*Devoted to the interests of the engineers and technical officials of the cities, counties and states*

AUGUST, 1939

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## TIMEWASTERS

The Problem of working up Problems is practically appalling, what with the hot weather an' all. And providing the solutions of those already published looms much worse after two weeks' absence and four weeks' work in the ten days that we have been back. Thanks to Messrs. Easton, Rowntree and others, however, some of this has been done. In the cask problem, there are several answers. If Gen. A has 2 full casks, one half-full cask, and 3 empty casks, Col. B may have the same, in which case Major C has one full, 5 half-full and 1 empty cask. But if Col. B has 2 full, 3 half-full and 2 empty casks, Major C may have the same as Col. B. As for Frank Daniels' boatman and the lost hat, he rowed at 2½ mph in still water; the stream flowed at 1½ mph; and it took him 40 minutes to capture the lid.

**Wood Butchering:**

Having a rectangular wooden block, 8 x 4 x 3¾, what is the maximum number of blocks 2½ x 1½ x 1¼ that can be cut from it?—*Stephen A. Derry.*

**Rapid Transit:**

Mikey starts out from home on an automobile trip. He travels 30 mph during the first hour, but finds this slow. So he steps up to 34 mph the second, then to 38 mph the third hour, etc., increasing his speed 4 miles each hour. Ikey decides to take after him, and starts 2 hours later to catch him. Ikey begins the day at 40 mph; but after the first hour he, too, speeds up, making 45 mph the second hour, 50 mph the third hour, etc. Provided everything holds together, how long will it take Ikey to catch Mikey and how fast will they be going at that time? Thanks to *John Bevan.* W. A. H.

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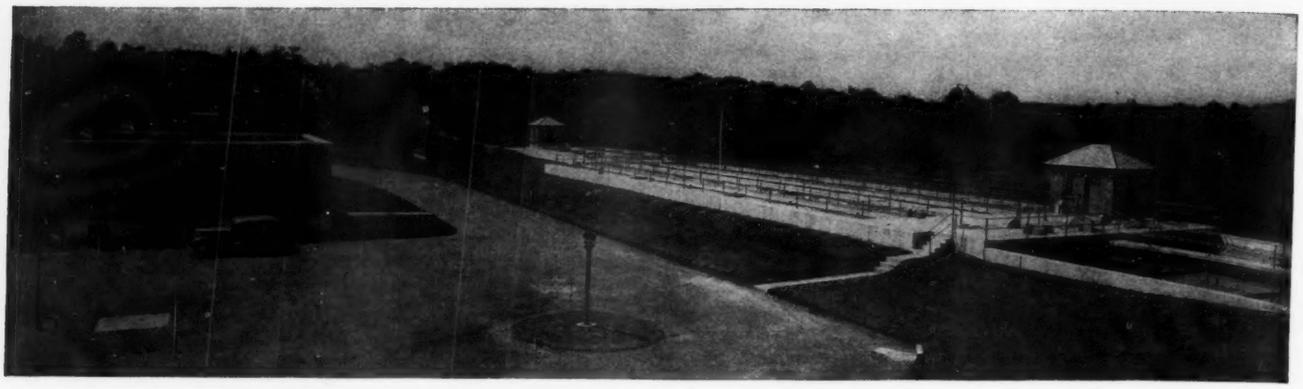

# Small Plant Operators Even More Than Large Need the Dependability of NORTON POROUS MEDIUMS

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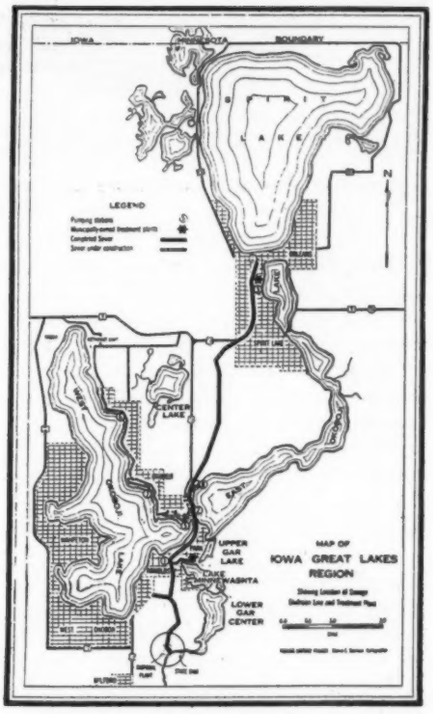
# Sewage Treatment for the Iowa Great Lakes Area

By A. DALE SWISHER

**In the Iowa Great Lakes region, sewage disposal problems incident to a resort area were solved by the construction of 22 miles of sewer, 21 sewage pumping stations, and a treatment plant designed for high summer flows and very low winter flows. The work was carried on as a Works Progress Administration project. Illustrations herewith are from the WPA.**




SPIRIT LAKE, East Okoboji, Upper Gar, Lower Gar and Minnewashta Lakes, along with a dozen smaller ones, occupy a 100-square mile area in northwest Iowa, and comprise the state's greatest recreational resource. Local sewage treatment facilities were inadequate, the plants at Arnolds Park and Spirit Lake being unable to handle the heavy loads imposed on them, and the smaller communities being forced to rely on septic tanks and outdoor toilets. As a result, lake pollution became a serious factor. Accordingly the Iowa General Assembly appropriated $125,000 for the work, and the project was approved by the WPA.

One of the first problems was to determine whether or not the sewage should be treated by each community or whether the sewage should be carried to the outlet river and given treatment as a whole.

If complete treatment by each group could be dependably assured during all seasons, this method would be desirable. However, the ease with which many plants can bypass their secondary treatment leads to doubt as to the dependability of this method. In addition, the construction of complete sewage treatment plants in some of the congested areas would be expensive in first and operating costs due to the necessity of odor prevention. Finally, isolated locations for individual treatment plants were not readily available. It was determined that this lack of suitable sites, the high cost of operating the two existing plants and the new plants that would have to be built would justify the construction of a common collection system and treatment plant.

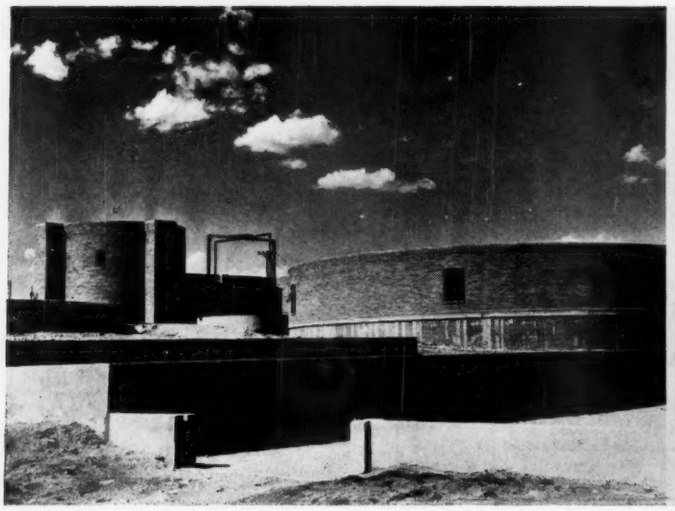
Having determined that one plant should be built, it was next necessary to determine its location and the quantity of sewage which it would be called on to handle. A detailed study of the growth of each town in the area was made. This set the estimated maximum population for 1955 at 36,000 and at 47,600 for the year 1990. Average winter populations for the same years were estimated at 4,000 and 5,000 persons. These two dates were selected because it was decided that the sewers should be built to carry estimated flows for 1990, while the plant itself was designed for estimated maximum flows for the year 1955. Plant design was then fixed at 0.75 mgd for the winter flows and 1.94 mgd for summer peak flows.

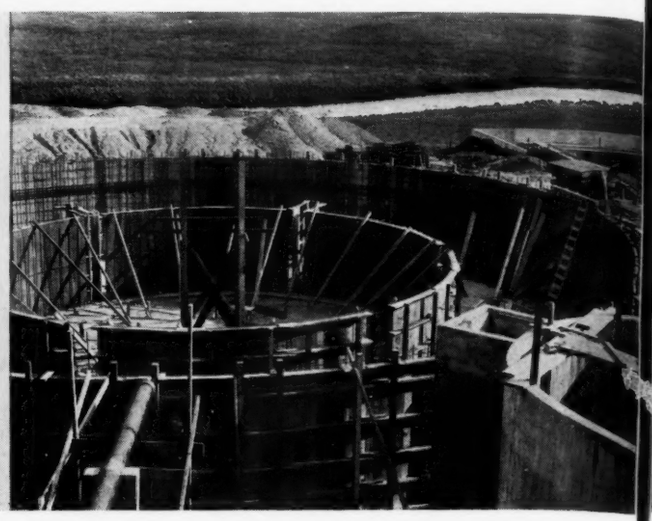
## Factors in Design

These flows were arrived at by using the following factors:

Permanent population contributing 80 gals. per capita per day.
Hotel guests contributing 50 gals. per capita per day.
Campers contributing 45 gals. per capita per day.
Cottages contributing 25 gals. per capita per day.

Infiltration was estimated to be 7,500 gallons per mile of sewer per day during the winter and double that figure during the summer.





**The striking view at the left shows the treatment plant, with the secondary clarifier and the heated digester in the background. At the right is claraetor under construction.**

The project was divided into two parts, Section "A" and Section "B." Section "A" includes the treatment plant, four pumping stations and an 8.69-mile interceptor sewer extending from Orleans, Iowa, to an outlet below the lakes on the Little Sioux River. This section does not give outlet facilities to all the lake communities, but it will serve the two main sewered cities of Spirit Lake and Arnolds Park. Two miles of this line are of cast iron; the remainder vitrified clay. Average cut was 14 ft.; maximum 23 ft. Sewers are from 6 to 21 inches.

Section "B" consists entirely of lateral or branch sewers to be connected to the main interceptor constructed under Section "A". The completion of these branches will provide facilities on both sides of Spirit Lake and on both east and west shores of Lake Okoboji, including the towns of Templar Park, Okoboji, West Okoboji, Terrace Park and Wahpeton.

The entire project involves the laying of more than 22 miles of sewers, the construction of 21 pumping stations and a 2 mgd disposal plant. The cost of this is estimated to be in excess of $1,500,000.

Construction of the diversion line was begun on November 1, 1937. All the activity was confined to that portion of the project until July, 1938, when erection of the treatment plant was started. Both units are being placed in operation for the 1939 summer session.

Primary function of the trunk line is to divert the sewage from the municipal plants at Arnolds Park and Spirit Lake but it also makes possible the extension of sanitary facilities to other points along the various lake shores, which when accomplished will greatly reduce pollution of these lakes. One such lateral line, extending through the town of Okoboji along the northeast shore of West Okoboji Lake, is now under construction but will not be completed for use during 1939.

The plant location was fixed at a point below the existing dam at the south end of the chain of lakes and since the outlet stream is small, it was imperative that the treatment plant be complete and produce a stable effluent. To this end an activated sludge type plant with heated digestion of solids was chosen.

It can be readily seen that any plant large enough to handle the flow from a peak population of 30,000 could not efficiently handle the correspondingly small flows from the winter population of only 3,000. For this reason the treatment plant was designed in two separate units, one of which will handle the winter flows and the other will function during the summer only. The various parts of the winter unit are covered to prevent freezing. This is a precaution not usually necessary, but it was taken in this case because of the low temperatures of the sewage entering the plant. These low temperatures may be explained by the fact that, without exception, the unusually cold water of the lakes is used as the source of the municipal water supply. The aeration tanks, sludge reactivation tank and the final clarifiers of the summer unit are not housed.

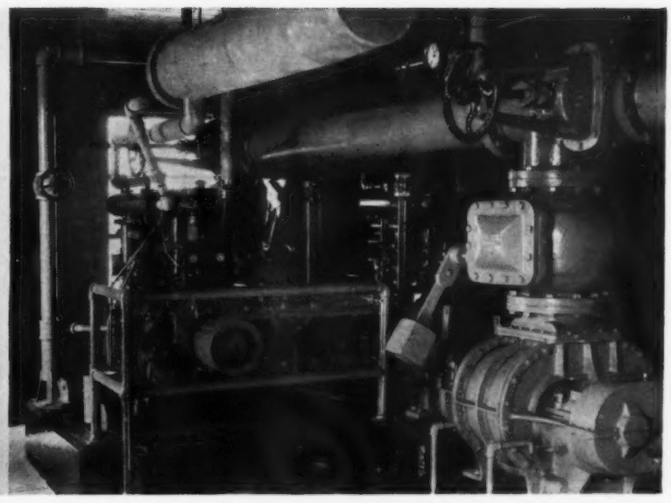
## Plant Details

The raw sewage enters the primary clarifiers by means of a distributor trough equipped with stop gates to permit using either one or both clarifiers. The winter clarifier is 12 ft. by 45 ft. and paralleling this tank is the corresponding summer unit—18 ft. by 45 ft. These sizes are based on a one-hour detention period and a surface area rate of 990 gallons per square foot per day for estimated maximum flow of 1.94 mgd. The settled sludge is scraped to the collecting hoppers by Chain-Belt collectors and then pumped to the heated digester by means of a 4-inch Chicago plunger sludge pump. The collecting mechanisms of both tanks are driven by a single drive unit, so connected that either mechanism may be taken out of service without interrupting the operation of the other.

Both primary clarifiers are skimmed by the use of compressed air under a pressure of about 6 pounds per square inch directed tangentially against the surface.

The effluent from these primary settling tanks flows to the aerators through measuring weirs. In the aeration tanks activated sludge is added and the mixture aerated and agitated for a period averaging about six hours by means of compressed air applied through 400 porous plates located along one side of the tanks.

The five aeration and one sludge activation tanks are located around the periphery of the final clarifier and are of such size as to provide an aeration period of six hours. The use of a common wall reduced the concrete quantities and thereby the costs. However, the chief advantage is the more uniform longitudinal flow of the sewage though the aeation tanks and consequently the larger and more uniform floc formed by the air and sewage particles.



**At the left is a typical excavation scene with skeleton sheeting. At the right is an engine that runs on either gasoline or digester gas.**

From the aeration tanks the sewage flows to the final settling tanks, where the activated sludge containing the solids is settled out. These tanks are circular, radial flow units designed for a surface area rate of 400 gallons per square foot per day and a detention period of 2½ hours. This gives a summer tank 48 feet in diameter with a side wall depth of 8 feet, and a winter clarifier 38 feet in diameter and the same side wall depth. Both tanks are equipped with Dorr mechanisms.

The effluent from the plant is then discharged to the outlet in the Little Sioux River; the sludge is pumped by three Yeomans pumps of 100 gpm capacity through a regulating weir box to the sludge activation tanks where it is aerated for a period of about four hours to recondition it. This sludge is then added to the incoming sewage. The solids removed from the sewage in the aeration process provide an excess of activated sludge. This excess is diverted by the weir box and is pumped to the primary clarifier, resettled and pumped to the digester along with the primary sludge.

As stated before the design of the aeration tanks about the periphery of the final clarifier permits great flexibility. For example, after a winter's operation one of the aeration tanks may be closed off and used as a second sludge activation tank. This will permit the building up of a reserve of sludge until there is sufficient supply to allow the summer unit to operate efficiently from the time it is put into service. By doing this any period of low efficiency while the plant develops an activated sludge will be eliminated.

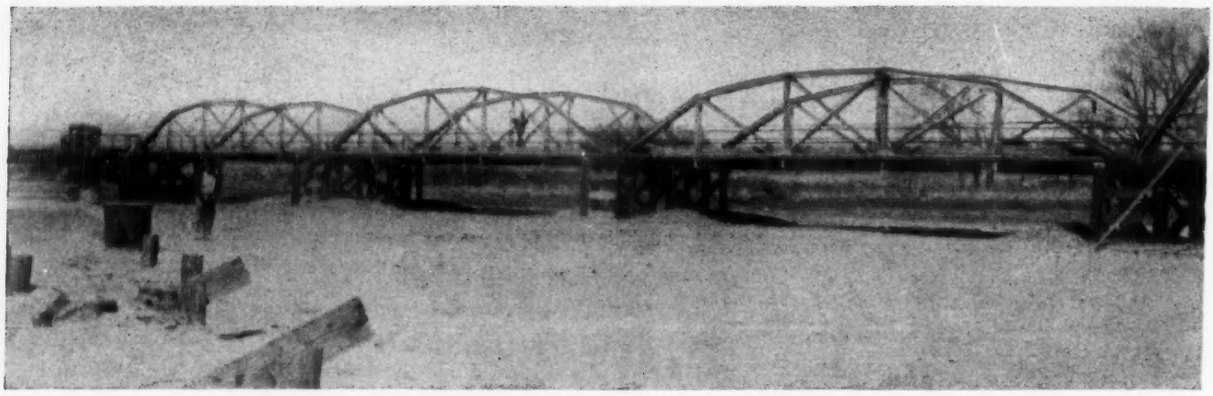
The digestion system consists of a 30-ft. diameter heated tank for primary digestion and a 38-ft. diameter unheated tank for settling and storage of the digested sludge. The heated digester was designed for 10-day storage capacity when treating sludge from a sewage have B.O.D. of 250 ppm and flowing at 1.3 mgd—the average summer flow. The sludge storage tank provides 4.0 cubic feet per capita based on a permanent winter population of 4,000.

Unsatisfactory experience with the usual method of heating digesters, that is, a pipe spiral fastened to the inside wall of the tank, led to the development of a sludge heater located in the control room. This unit utilizes a 500 gpm Yeomans sludge circulating pump forcing sludge through a cylindrical shell and around a pipe coil containing circulating hot water. Sludge or supernatant liquid may be drawn off or returned to the digester at any of five different levels, thus insuring that the completely digested sludge will remain undisturbed at the bottom of the digester. There is also a three-point supernatant liquid drawoff discharging to the sludge storage tank.

It should be noted here that the digester and sludge storage tanks are not built in duplicate as are the other units of the plant, as the requirements of this step are quite different from those of the other units. At the temperature obtained through the sludge heater the digestion process is completed in about a month. After this time has elapsed the resulting sludge may be dried on the sludge drying beds if the weather permits. These beds are 120 ft. by 65 ft., or a total of 7,800 square feet. The design called for 1 square foot per capita based on the winter population plus 0.25 square foot per capita based on the average summer population. However, during the winter months drying on the outdoor drying beds is usually impossible. For this reason storage must be provided. It is expected that after the summer peak there will be time for the sludge collected during the summer to be digested and dried before the summer drying season in over. A portion of the summer digestion capacity may then be used for storage of the digested sludge during the winter when drying is impossible.

Gas collectors are provided on both the primary digester and the sludge storage tank to handle the anticipated 0.3 cubic foot per capita per day yield. To supply the 1 cubic foot of air per gallon of sewage required in the aeration tanks two 600 cfm Connorsville-Root blowers have been installed in the control house. These are driven by Climax Engineering Company's sewage gas-gasoline engines. These two 50 horsepower engines operate on gasoline until such time as the summer load begins and before additional gas is generated from the additional summer sludge. The heat from the exhaust gases of the engines is extracted in a heat exchanger and used to heat the water used in the sludge heater. Hot water lines also extend to the 3,000 cubic foot gas holder to prevent freezing of the liquid seal. Water for general use about the plant is secured from a 25-ft., 72-inch gravel packed well beneath the pump pit between the summer and winter final clarifiers.

The plans were prepared under the direction of D. H. Currie; the writer assisted in design. J. A. Dunkel acted as construction supervisor.



This is the bridge that was moved. Old foundations are shown at the left.

# Moving and Raising Three 70-Foot Steel Trusses

By L. A. TILTON
County Engineer, Barber County, Kansas

THE original bridge across the Medicine River was located at right angles to the stream bed, making about a 30 degree angle with the section line, on which the road was located. The river has since cut through a large loop and was going south of the present bridge. It was decided to move the bridge to give better alignment, and to add length to care for the changed conditions necessitated by the new location. The change required an angular as well as a lateral movement.

In constructing the new piers, creosoted Southern Pine piling was driven to bed rock, with an average penetration of 20 feet below stream bed. Four piles were driven under each bridge shoe; two piles were driven betwen the two clusters to help support the floor system. Where the pier was located in the stream bed proper, another pile was driven about four feet up stream to act as a breaker to deflect trash and trees. Thus a total of eleven piles was driven for each bridge pier. Caps of 8 by 10-inch timber were placed upon the piling to support the steel trusses.

After all of the piers were in place and ready for the superstructure, the raising and moving of the steel trusses was started. A 7″ by 15″ timber was fastened to the lower chords, as near the bridge shoes as possible. An iron plate, ¼ inch by 18 inches, was then fastened to the bottom of this timber, then an oak block was placed between the lower chord and the end post, so as not to bend the lower chord.

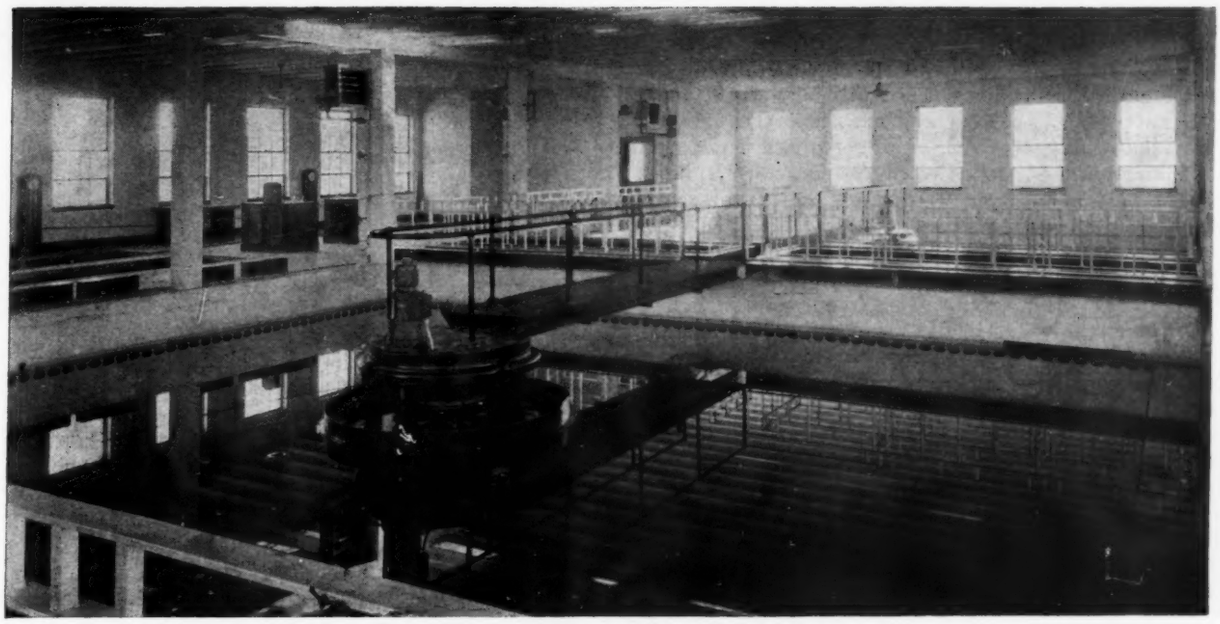
A spread footing was made below this and a timber crib was laid up within about 2 feet of the bridge floor. Hydraulic jacks were placed on the cribbing and under the corners of the bridge, raising one end of the bridge about 10 inches. The bridge was then blocked over the pier in such a manner, that the jacks could be placed directly on the bridge shoe. The other end of the bridge was raised in the same manner. The jacking was continued alternately and the cribbing was laid up as the jacking progressed, until the entire span was raised about 5 feet.

Cribbing was then laid from the old pier to the new pier, care being taken that the center line of the cribbing was the same distance apart as the 7″ x 15″ beams. A line of 12″ by 12″ stringers were placed upon the cribbing; 4 lines of 60-pound railroad rails were spiked to each of the 12″ x 12″ stringers; 14 extra heavy oil field pipe rollers, 4″ in diameter and 2 feet in length, were placed upon the rails and the bridge lowered onto the rollers.

The bridge was now ready to roll into the new location and to do this a winch line was fastened to the bridge near the south quarter point. A snatch block was fastened to the far side of the new pier and the truck on the adjacent span. The location of the winch line was varied according to the amount of pull required to move the south end of the bridge faster than the north end, due to the angle between the old and the new location. The rollers were also used to guide the span as it was moved. The span was rolled over to the new piers without any trouble, and raised just enough to remove the rails and rollers; it was then lowered into the exact location and the cribbing was removed. The same procedure was followed in moving the remaining two spans. The concrete floor on the spans was not damaged and no cracks occurred.

The crew moving the bridge consisted of L. H. Nurse, the bridge foreman; one truck driver; and three regular bridge men. We also had from 8 to 10 relief workers who assisted in the building of the cribbing. The three steel spans, with a concrete floor were moved in 10 days actual time.

From the picture it will be noted that two other steel trusses have been added. These were obtained from an abandoned bridge several miles away and were dismantled and then reerected. They are shown at the ends in the illustration.



The settling compartment of the Little Falls plant.

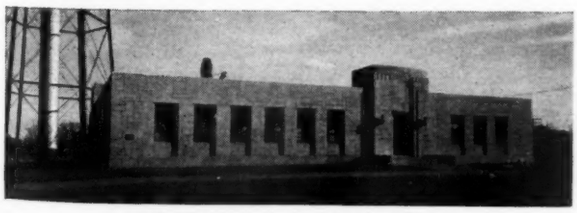
# New Softening Plant Greatly Improves Quality of Water

By C. E. McPHERSON
Chemist in Charge, Little Falls, Minn.

**A plant, built as WPA project at a cost of more than $350,000 has produced an excellent water, soft and free from iron and manganese. Higher consumption may obviate necessity of raising rates further.**

THE water supply for the city of Little Falls which has a population of about 5,500 is obtained from eleven twelve-inch wells, running from 35 feet to 108 feet in depth. While the quantity of water is ample, not only for present but for future needs, the quality has been poor because of the high degree of hardness, high iron and manganese content and the color. Chemical analysis of the water indicated a hardness of 265 to 300 ppm, an alkalinity of 276 and iron content of 1.4. For drinking, for household use, or for industrial use the water left much to be desired.

For these reasons, city officials in November, 1935, accepted the offer of the Works Progress Administration to construct a softening plant as a WPA project. The plant is located on the northern edge of the city. The elevated storage tank and the wells are located in the same area, and the tract is large enough so that it is planned to utilize eventually a large portion as a recreation and park area with a swimming pool, tennis courts, playground area, baseball diamond and picnic ground. The plant was so designed and constructed that it would fit well into this park area.



What the new plant looks like.

The plant building is 102 feet by 104 feet and about a story and a half in height with a full basement. The superstructure is of gray granite, all quarried locally, cut and bush hammered by WPA workers and set into place by WPA stone setters. The inside trim, the window sills, the curbings around the clarifiers, mixing chambers and filters are all of a very beautiful polished black granite, also quarried locally, polished and set by WPA workers. Foundations and all basins were reinforced. Construction quantities included 23,600 c. y. excavation, 1,200 c. y. of concrete, and 22,000 c. f. of cut stone.

The plant is designed to handle 1,500,000 gallons of water per day. The raw water is pumped into the treatment plant by two low service, 520 gpm pumps with 7½ hp motors. Ammonia is fed into the raw water on the suction side of the pumps. Lime is weighed into a feeder and slaker from a lime storage room over the slaker and goes from the slaker to the mixing chambers in solution. The chlorine is introduced at the rear end of the mixing chambers. Eleven grains of lime per gallon are used to soften from 270 ppm to 100 ppm.

The mixing chamber is 9 by 9 by 40 feet. The water is retained here in the first stage of the treatment process for a period of thirty minutes. From the mixing chambers the water goes to the clarifiers which are 9 feet deep and 35 feet in diameter. The clarifiers are provided with continuous sludge removal equipment and the retention time is two hours and fifteen minutes.

The partially treated water next goes to the recarbonation chamber. This chamber, 9 by 9 by 40 feet, is located between the two clarifiers. Gas is taken in the stack of a boiler which is equipped with two oil burners and put through a scrubber and compressor. It is then applied to the water in the recarbonation chamber.

From the recarbonation chamber the water goes to the filters which are eighteen feet square and are operated at the conventional rate of two gallons per square foot per minute. The filters are made up of 24 inches of .45 mm diameter sand supported by eighteen inches of graded gravel. The treated water now goes to two wells located under the filters. These wells have a combined capacity of 40,000 gallons. From the wells the water is pumped by a 650 gpm pump with a 40 hp motor to the 200,000 gallon elevated tank located just outside the plant or pumped directly to the distribution system. A 1,000 gpm pump with a 75 hp motor is available for fire or emergencies.

Since iron and manganese are removed also, aeration is not necessary. The plant has a well equipped laboratory where chemical and bacteriological tests are made daily.

The total cost of the plant was approximately $353,117 distributed as follows:

| | | |
|---|---|---|
| Federal contribution (WPA) labor cost | $270,461.00 | |
| Other costs | 52,656.00 | $323,117.00 |
| Sponsor's contribution | | 30,000.00 |
| Total cost | | $353,117.00 |

It is interesting to compare the chemical analyses of the raw and treated water. Figures for the raw water were given previously but are repeated here.

| | *Raw Water* | *Treated Water* |
|---|---|---|
| Hardness | 265. ppm | 95.6 ppm |
| Alkalinity | 276. | 108. |
| Iron | 1.4 | none |
| Chlorine | ..... | .03 |

Naturally the cost of treatment is an added expenditure which had to be provided for. The first year of operation has indicated an increased cost due to treatment of approximately $.035 per thousand gallons. This cost may be broken down as follows: Chemicals $.011 per thousand gallons; power $.020; oil $.004; total $.035.

It was found that the water rates in effect before the water was treated in any way would be inadequate to meet the necessary increase in costs due to treatment. Therefore a somewhat arbitrary raise in rates, approximately 25 per cent, was authorized by the council pending a thorough study of costs after the plant has been in operation for some time. Upon this study a later rate revision may be based. Former and present water rates are as follows:

OLD RATE

| | | |
|---|---|---|
| Minimum rate, 7,000 gal per qr | | $3.00 |
| 1st 10,000 | 40c per M gal per qr | 4.00 |
| 2nd 10,000 | 25c per M gal per qr | 2.50 |
| 3rd 10,000 | 20c per M gal per qr | 2.00 |
| 4th 10,000 | 15c per M gal per qr | 1.50 |
| 5th 10,000 | 10c per M gal per qr | 1.00 |
| 50-100,000 | 8c per M gal per qr | 4.00 |
| Over 100,000 | 6c per M gal per qr | |
| 100,000 gal | | $15.00 |

NEW RATE

| | | |
|---|---|---|
| Minimum rate, 8,000 gal per qr | | $4.00 |
| 1st 10,000 | 50c per M gal per qr | 5.00 |
| 2nd 10,000 | 30c per M gal per qr | 3.00 |
| 3rd 10,000 | 25c per M gal per qr | 2.50 |
| 4th 10,000 | 20c per M gal per qr | 2.00 |
| 5th 10,000 | 15c per M gal per qr | 1.50 |
| 50-100,000 | 10c per M gal per qr | 5.00 |
| Over 100,000 | 8c per M gal per qr | |
| 100,000 gal | | $19.00 |

However, a steady increase in per capita consumption since the installation of the treatment plant has, in itself, provided some increase in revenue to meet the treatment cost. Per capita consumption prior to treatment was 92 gallons. Already this has increased to 105 gallons.

In any event it would seem that the cost of treating the water would be justified when it is considered that householders and industries now have available a clear, soft, good tasting water instead of the hard, malodorous brownish-red water that was not pleasant to drink, that stained plumbing fixtures and clogged pipes and boilers.

A summary of operating results for the year ending March 31, 1939, is as follows:

| | | | |
|---|---|---|---|
| **Income** | | | |
| Water sales | | | $11,691.15 |
| Hydrant rental | | | 8,395.53 |
| Other income | | | 1,961.95 |
| | | | $22,048.63 |
| **Operating Expense** | | | |
| Labor salaries | | $ 4,829.83 | |
| Wages | | 332.60 | |
| | | $ 5,162.43 | |
| Power | | 3,268.63 | |
| Fuel oil | | 1,012,56 | |
| Lime, chlorine, ammonia and other supplies | | 2,345.92 | |
| Other costs, including insurance, office supplies and equipment, telephone, collections, etc. | | 6,182.38 | $17,971.92 |
| Net operating income | | | $ 4,076.71 |
| **Disposition of Income** | | | |
| New construction | | $ 1,184.53 | |
| Bond retirement | | 4,500.00 | $ 5,684.53 |
| Reduction of surplus | | | $ 1,607.82 |

Since the new water rates were in effect only part of this year and the consumption is increasing, it is only logical to expect an even better showing in future years.

This article was adapted from the original article by Mr. McPherson in *Minnesota Municipalities*. Illustrations were furnished through the courtesy of the St. Paul office of the Works Projects Administration.

## Industry's Hottest Flame

The oxy-acetylene flame, which is produced by igniting a mixture of oxygen and acetylene yields an incredibly intense heat—approximately 6,000 deg. F. Controlled by a blowpipe, this flame is used today for hundreds of welding and cutting operations. In welding, it readily fuses two pieces of metal into a single, seamless piece, while in cutting, it can, by the addition of a jet of oxygen, instantly cut through heavy sections of steel and iron.

# Balancing a Bridge and a Bridge Budget

The bridge, showing construction work under way.

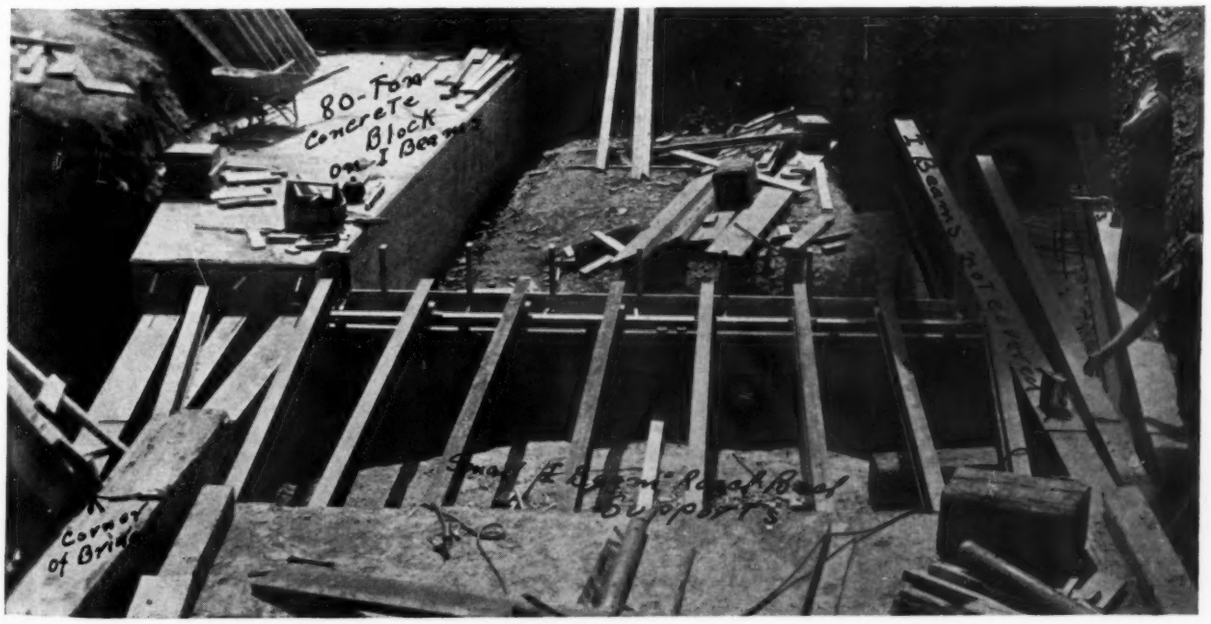
By C. M. RUSSELL

WHEN water undermined the foot of a 30-foot sandstone cliff which served as the base for one end of the 60-ton single span Hay river bridge in Dunn county, Wisconsin, Highway Commissioner Herman Gunderson was faced with state commission estimates of at least $10,000 for the construction of a concrete abutment from the river bottom.

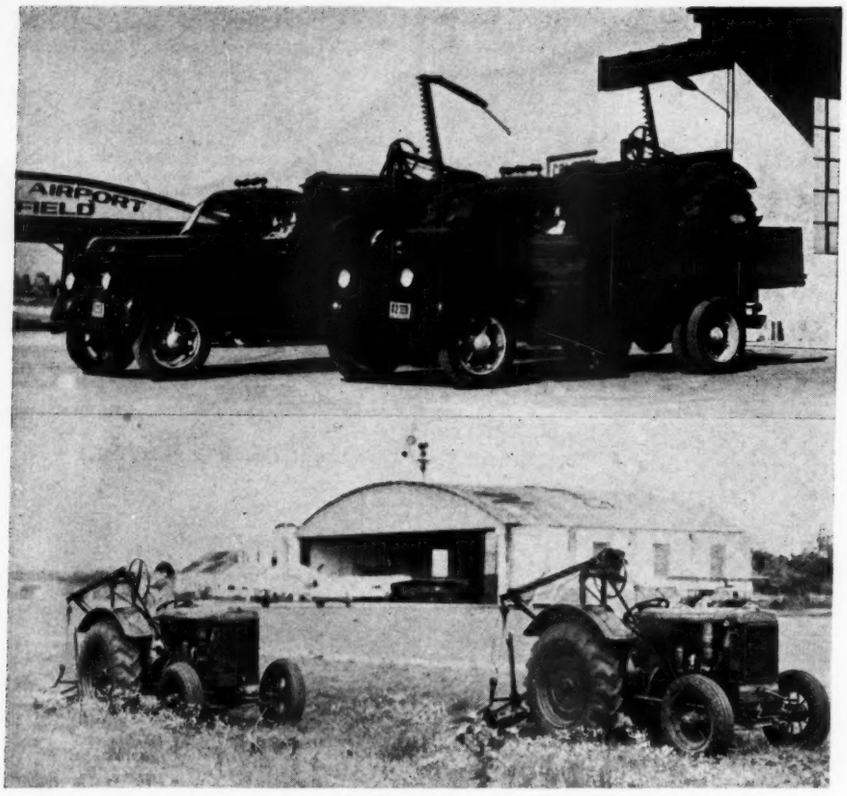
Pencil in hand, Mr. Gunderson started to do some estimating of his own and emerged with an estimate of $4,000 for the construction of a giant "teeter-totter" for the support of the bridge without teetering or tottering. The estimate even took care of the reconstruction of the approach, and tests made at the re-opening of the bridge the first week in June showed that the bridge didn't yield more than an eighth of an inch with a ten-ton truck cutting didoes on the newly supported end.

Thirteen feet back from the end of the bridge, a fulcrum of concrete buried 12 feet in the rock was constructed with wide bases at each end. Across these bases were laid two 24″ x 7/16″ x 39′ I beams and one 20″ x ½″ x 30′ I beam with the outer ends welded together under each corner of the bridge and the inner ends stretching 26 ft. and 17 ft. back onto a base of solid rock. Between the spread inner ends of the beams 1-inch rods of reinforcing metal were driven at angles deep into the rock and anchored with concrete. Over the whole was poured a block of solid concrete weighing 80 tons.

The completed job shows 30 tons of the weight of the bridge span supported on the ends of the six I beams weighed down at the farther side of the fulcrum by the equivalent of more than 180 tons of I beam weight, concrete and fill. Waste material was shoved off below the approach into the water to protect the base of the cliff from further erosion and this will be maintained as necessary. Mr. Gunderson feels that he has accomplished an otherwise costly repair job at a very considerable saving over more conventional methods.




This shows how the end of the bridge was supported on I-beams set in concrete blocks.




**In the upper view are shown the trucks loaded and ready to go. Below is a pair of motor driven mowers at work.**

# Traveling Motorized Outfits Maintain South Carolina's 24 Airports

SOUTH CAROLINA AERONAUTICS COMMISSION has solved economically a knotty problem of maintaining the 24 airports in the state.

Municipalities often exhaust their appropriations in building their airports and have nothing available later for maintenance. A neglected airport can quickly become a hazard to aviation instead of an aid. Tall grass and weeds are particularly dangerous, for they not only interfere with landing and take-off but often cover up bad places such as holes, ruts and soft spots. This work is handled by three International wheel tractors equipped with mowers, and three International motor trucks for speedy movement from airport to airport, as required.

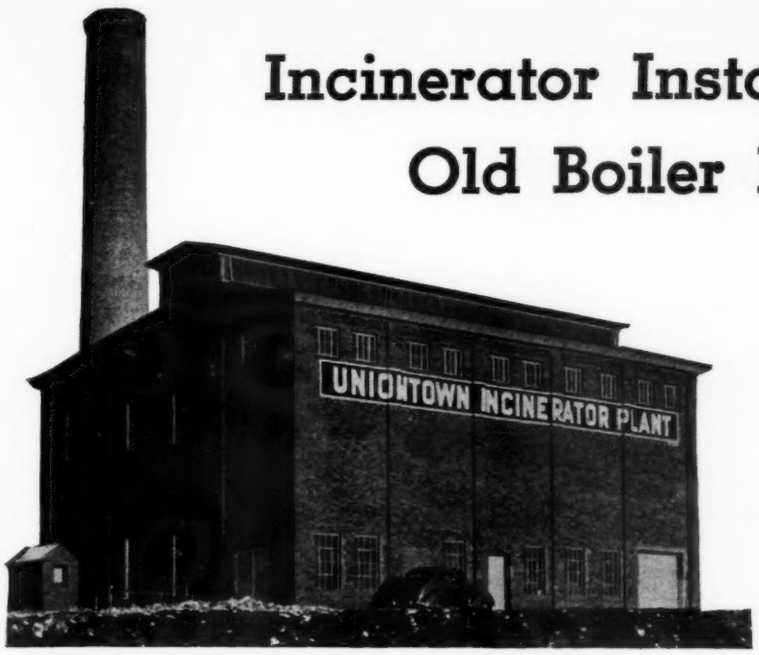
Each of the trucks is provided with special sideboards, as shown in the accompanying illustration, which can be removed and then fastened to the rear to serve as runways for the tractor to travel onto or off the truck under its own power. The 7-foot vertical lift mower attached to each tractor is of recent development. It is designed so the cutter bar may be raised to full vertical position for passing obstacles without having to stop the tractor or disengage the power take-off shaft. The cutter bar can also be operated at extreme uphill or downhill angles in cutting grass along drainage ditches or banks at edges of fields. From 25 to 35 acres may be cut with the mower per day.

While one of the tractors is at work mowing, the motor truck that conveyed it to the airport is employed on various maintenance jobs, particularly in conveying dirt to fill any holes, ruts, and soft places, which are often discovered after the grass is cut. The tractor, which has a maximum engine horsepower of 22 and operates at speeds of 3½ to 10 miles an hour, may also be utilized for a variety of maintenance work.

Of the twenty-four airports in South Carolina, fifteen are of the landing strip type, five are all-way fields, and four have paved runways. They have a total area of 2,704 acres, 1,848 acres of which are suitable for various types of aircraft operation. It takes from two to seven days to mow an air field completely and it is necessary to cut the grass about every month and a half. With these three motorized maintaining outfits all twenty-four fields in various places in the state are being efficiently served.

In March, 1935, the legislature of South Carolina passed the State Aeronautics Regulatory Act which created the South Carolina Aeronautics Commission and included in the bill provisions for promoting the welfare of aviation within the state. With Dexter C. Martin as director and E. F. Markwood, assistant director, the commission has accomplished much in establishing an efficient, planned system of airports and airways in South Carolina. The commission is supported entirely by funds provided from the state aviation gasoline tax.

# Incinerator Installed in an Old Boiler House




Old boiler house used for incinerator.

By WILBUR L. DUNN
City Engineer, Uniontown, Pa.

**Uniontown, Pa., needed a 75-ton incinerator and was in luck—it bought at a bargain a large boiler house into which the incinerator fitted nicely. It even had an ash tunnel in just the right place, so that incinerator ashes can be dropped right into trucks. The whole, including 21 acres of land and 4 collection trucks, cost $55,000.**

UNIONTOWN, Pa., is a city of about 25,000, situated in Fayette County, in the southwest corner of the State, in the heart of the bituminous coal field. For many years the problem of disposal of garbage and commercial rubbish has been a difficult one, as Uniontown is a shopping center for a population of at least 150,000 people, and nearly every large chain store system has a store here, and the amount of waste, such as cartons and boxes, is very large. In the past, this waste has been hauled and dumped wherever a place could be found, and this did not add to the beauty of the surrounding country. The garbage was hauled by contract and fed to hogs or plowed under; neither of these methods was satisfactory, so the city began to gather data on incinerators. From information collected, we found that a plant to serve our needs would cost, without the site, from $80,000 to $90,000, and that seemed too high.

At an abandoned coal mine, about one and a half miles from the city limits, stands a large boiler house to which one of our councilmen, Cameron J. LaClair, called the attention of City Council. This building is 80′ by 48′ by 35′ to the square, has steel frame, solid brick walls, concrete floor and concrete roof, with an ash tunnel large enough to drive a truck into, and a radial brick stack 150′ high.

This building, with twenty-one acres of land, was purchased from the owners for $10,000. Three large 300 H.P. Erie boilers, several fans and pumps, and other machinery went with it, which the city sold as scrap iron for almost $1,500. Windows and doors were repaired and the building put in good shape. The structure is located on a hillside, and a road runs along the high side at the exact level of the charging floor, needing only a ramp about twenty feet long to reach from roadway to floor.

Stoking floor and furnace fronts.

Charging floor and openings into furnace.

MR. DUNN

A contract to construct a 75-ton incinerator was awarded to the C. O. Bartlett and Snow Co. of Cleveland, Ohio, for a sum of $29,995. This included furnishing all plans, materials, and work; also removing 60′ from the top of the chimney and lining it the entire remaining height with fire brick, installing lightning rods and a metal cap. This work was started Dec. 1, 1938, and completed Feb. 1, 1939. A drying fire was built that day. This furnace is equipped with a carborundum preheater and fan, forcing hot air under the furnace when needed; also with heat-recording instruments and all appliances necessary.

One feature of this plant is unusual. The old ash tunnel, which ran under the old boiler, was found to be in the exact position required by the incinerator furnace. The furnace has drop grates in each cell through which all ashes and incombustibles are dropped directly into ash hoppers in the roof of the tunnel. When these hoppers are full, a truck is backed in and the ashes dumped directly into the truck and hauled to the dump. No scraping or shovelling is required and the stoking floor is always clean and clear.

This furnace was put into operation March 1, 1939, and is performing satisfactorily. The city purchased two "Collecto" body garbage trucks and two high-side rubbish trucks, of 8 cu. yd. and about 15 cu. yd. capacity, respectively.

I am sure that after a short time we will have things working smoothly and get maximum efficiency from our plant. The building has water and electricity, and is sewered, and we expect to install toilets and showers soon. We have invested in plant, land, trucks, etc., about $55,000 which is very reasonable for such a modern plant.

Household garbage is required to be drained and wrapped in paper. This and combustible rubbish may be placed in the same can; or the latter may be bundled separately. Non-combustible rubbish and ashes may be placed in the same can. Cans containing garbage must be water tight and of not over 18 gal. capacity. Fees are charged for collection, 60 cts. per month, or 75 cts. if not paid before the 10th of the following month; or 55 cts. if paid quarterly in advance, or 50 cts. if paid annually in advance. Household garbage is removed once a week during November to April, twice a week during May to October; non-combustible rubbish and ashes once a week; hotel garbage and ashes daily. The refuse collection ordinance is enforced by the Board of Health.

## Regulating Roadside Parking With Safety Posts

In an effort to curb the increasing hazard of cars being parked too close to state highways, especially cars of motorists who park by roadside taverns or stands, the Safety division of the Minnesota Highway department plans to lessen this danger by setting up a line of posts a reasonable distance from the highway, and prohibiting parking between the posts and the highway. In the past, motorists have been in the habit of parking just off the highway when they stop to seek refreshment in these taverns or stands. Consequently they have created a serious and mounting traffic hazard that must be dealt with adequately. Posts will be installed a sufficient number of feet from the highway to permit travel to pass by, but still allow enough space for those stopping to enter and leave the grounds safely and quickly.

# A Modern Highway Garage and Office

By C. R. BAXTER
County Superintendent of Highways

THE New Adams County highway garage and office building was built under P.W.A. It was dedicated in February with seven hundred people attending. Ernst Lieberman, Chief Engineer of the State Highway Department; George Baker, Engineer of County Roads and City Streets, and Professor C. C. Wiley of the University of Illinois spoke at the dedication.

The building is 62 by 113 ft. with two stories in front, the downstairs housing the County Superintendent's office and also offices for the assistant in charge of maintenance and for the assistant in charge of construction. The second floor when finished will house the drafting and blue printing room. The building also serves as a garage with adequate storage space for road machinery, and provides a modern repair room with necessary hoist for proper maintenance of the machines. The basement under the main floor contains a modern oil furnace, which furnishes automatic heat for the building. The roof is of steel truss with no center supports, which gives a large clear floor space uninterrupted by columns or supports of any description.

We are very proud of our building and feel it is one of the most modern county units in the State. With a building of this type we will be better able to build an organization and maintain equipment that will give us one of the most economical maintenance forces of its type in the country.

Adams County, Illinois, Highway Garage and Office Building.

# The Editor's Page

## Garbage Collection and Disposal Problems

Progress in collection and disposal of garbage has been halting and feeble, as compared to sewage. We agree completely with a recent statement before the Conference of State and Territorial Health Officers that "the methods of garbage disposal have not kept pace with improvement in other municipal sanitary services." However, this lack of progress has not been due to lack of knowledge regarding disposal; rather it has been due to the disinclination of municipalities to abandon insanitary and outmoded methods for more modern ones.

Garbage dumps can be made sanitary, but they rarely are. The result is almost always a nuisance, with rats, flies, mosquitoes and other vermin abounding. It is easy to allow well-planned disposal by dumping to deteriorate into a year-around nuisance—it reminds us of the drunk who claims he can "take it or leave it alone." An incinerator practically guarantees sanitary disposal and costs but little more than sanitary dumping, as a rule.

Collection vehicles, in most cities, are far from being satisfactory. Too often, if cleaned, deodorized, disinfected, and sterilized, they would make good museum pieces. Some progress has been made in providing covered, tight, easily cleaned, low-loading, light-weight units for small municipalities; but there is room for lots more improvement. In the pages of this magazine we have illustrated and described every effort along this line that has come to our attention, and we shall continue to do this in an attempt to raise the standard of collection and disposal practice.

## Roads and National Defense

During this month, in northern New York, war games will be carried on in an effort to work out certain problems in defense, and also to test the utility, in the field, of motorized units of the army. Not long ago, one of the streamlined motorized divisions traveled 300 miles in a single day over Texas roads. Such mobility introduces an entirely new element into war.

One of the most interesting sidelights on modern mobility was the order directing various of the motorized units to the maneuver area. These units were directed to leave New York City at 7 A. M. and to arrive at Plattsburg Barracks, some 300 miles away, before noon of the next day. No matter what the outcome of the tests of the motorized units in the actual games, good roads and modern equipment will have permitted a mobilization of war equipment, 300 miles away, in the time it took our civil war divisions to march 20 miles.

Even though generals seem to have an incurable desire to fight battles where the roads are poor, water scarce and all the comforts of home missing, modern equipment and modern highways will make it quicker and easier to get there, and to bring up the food, munitions and other essentials that are needed for a first-class battle.

## Educational Opportunities for the Sewerage Operator

Following our editorial comment in the June issue regarding educational opportunities available for water works superintendents through a forthcoming correspondence school course, several letters have been received from men in the sewerage field asking why they were left out. Well, they aren't. What we have always considered to be the leading correspondence school in the country will have available very shortly two complete courses on these subjects. One of them will cover "Operation of Water Plants"; the other will cover "Operation of Sewage Plants." Both are complete, thorough and carefully prepared. We believe that they will be of inestimable value to many engaged in these two fields of work.

## The Taxation Load on Highway Users

Motor fuel taxes and registration fees represented 38.5% of all state taxes during 1937, according to a report of the Federation of Tax Administrators. Fuel taxes amounted to 29% and registration fees to 9.5%. This total does not include the many other taxes that are levied on motorists, including operators' licenses, municipal licenses (which are levied in some states), personal property taxes (also a specialty of certain states), and many other varieties of the same.

Last month we had occasion to remark on the tax burden on New York motorists, but apparently other states are just as bad as the Empire State. And a recent bulletin from the Highway Users Conference says, in regard to 1939 motor fuel taxes, that the so-called "emergency" taxes have all been continued; one increase, no reductions; attempts to reduce defeated in 10 states; attempts to increase defeated in 11 states. Registration and license fees have been increased in 6 states and decreased in 3 states.

## Water As It May be Purified

In a recent address, a Chemical Warfare officer stated that water which had been contaminated with mustard gas could be made safe and fit for drinking by adding one pound of 70% hypochlorite to each five gallons of water and boiling for one hour. This seems very heroic treatment and we question whether the water would be better or worse. The addition of 16,000 parts per million of chlorine to water is a little beyond the experience of most water works men. Certainly it ought to accomplish some results, good or bad, but not indifferent.

In the Old World, much thought has been given to the possibility of contamination of water supplies by aerial bombing, but little has been done, so far as is known, that would be of highly practical value in case such contamination should occur. In this country, where the likelihood of such events is far less, research has been carried on for two or three years, with every indication that the problems that might conceivably arise could be taken care of without undue difficulty or cost, and without resort to the method mentioned above.

# Bituminous Emulsions in English Road Construction

INFORMATION on the present status of bituminous emulsions in English road construction has been issued by the Technical Committee of The Road Emulsion and Cold Bituminous Roads Ass'n, Ltd. The following information is adapted from a report by that committee.

Bituminous emulsions may be roughly grouped into three main classes, namely, unstable or labile emulsions, semi-stable emulsions and stable emulsions, depending on the resistance of the emulsions to coagulation or breaking in use. The resistance to breaking in use is in turn dependent on the purpose for which the emulsion is to be used, and is controlled by the amount and nature of emulsifier or stabilizer used in the manufacture of the emulsion.

It should be emphasized that there is no distinct dividing line between the three classes of emulsion, and the first and second or second and third classes may merge into one another under certain conditions, as, for example, with a particular type of aggregate or under certain conditions of application.

Each of the three classes of emulsion may be further sub-divided into groups based on the viscosity and/or bitumen content, dependent on the purpose for which the emulsion is to be used.

Finally, each of the three classes of emulsion may contain as the binder to be deposited on the road or aggregate either asphaltic bitumen, tar, or both.

Semi-stable emulsions were designed to render possible the preparation of cold bitumen carpets. The emulsion used for these purposes must, of course, be sufficiently stable to permit of the coating of the aggregate without risk of breaking of the emulsion before coating is complete, and in the case of the semi-stable type of emulsion this increased stability is generally obtained by the use of larger amounts of the same types of emulsifier as are used for the unstable emulsions.

The properties of semi-stable emulsions, with the exception of the rate of breaking, are similar to those of surface dressing and grouting emulsions; although no official specifications have been issued for the emulsions themselves, B.S.I. specifications covering the construction of single coat and two coat asphalt with emulsions were issued in 1933. Semi-stable emulsions are finding extended application in the construction of footpaths and playgrounds and tennis courts.

The early tar emulsions manufactured were also of the semi-stable type since, owing to the higher specific gravity of tar as compared with asphaltic bitumen, it was necessary to employ different kinds of emulsifier than those used with bitumens in order to ensure satisfactory storage stability; these emulsifiers conferred greater resistance to breaking than was desirable in surface dressing and grouting emulsion.

Tar emulsions are now produced in types similar to bituminous emulsions, the main difference being in the characteristics of the bituminous material.

The most recent developments in the emulsion industry have been concerned with the manufacture and application of emulsions for use in mixing processes, in which the aggregate may contain large amounts of fine material or may consist entirely of fine material.

This type of emulsion is known as "stable" emulsion and is characterized by great resistance to coagulation by chemical or mechanical means so that the emulsion is able to withstand mixing with very fine powders, or even cement without risk of breaking of the emulsion. Such emulsions have been available for a number of years, but progress is still being made in the manufacture, more especially in the nature and amount of emulsifier or stabilizer, and insufficient experience has as yet been gained to permit of the standardization of stable emulsions.

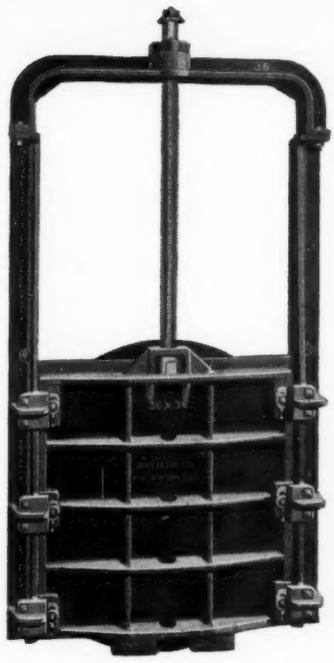
Stable emulsions can be satisfactorily used with such aggregates as ash, chalk, hoggin and sand for such purposes as cheap footpath construction; it is also possible to use these materials for mixing in situ where large areas are being treated such as car parks, airport runways and recreation grounds. Another important use is mixing on old waterbound surfaces.

The properties of stable emulsions such as storage stability, homogeneity, resistance to low temperature and viscosity are similar to those of other types of emulsion, and the same methods of test are used to evaluate these properties; but it has not been possible up to the present to develop a method of test which will permit of the differentiation of semi-stable and stable emulsions according to their resistance to breaking in use. It is, of course, possible to determine whether an emulsion is sufficiently stable for use with a given aggregate by performing a simple mixing test with the materials it is desired to use; although this is the procedure at present adopted by manufactures of stable emulsions, it is desirable to have a method of test for inclusion in a standard specification, which does not depend upon the necessity for obtaining samples of the aggregates to be used.

A considerable amount of work has been undertaken in an attempt to discover a material of constant composition which will place stable emulsions in the same order as is indicated by their behavior in practice with soils and aggregates, but so far no material has been found satisfactory with all stable emulsions.

As mentioned above, stable emulsions are used in mixing processes where the aggregate contains large amounts of fine material, and one of the most important fields of application of this nature is in the stabilization of soil for low cost road surface construction, and for construction of aerodrome landing grounds, recreation grounds, footpaths, etc.

Emulsions would appear to be particularly suited to this form of construction on account of their low viscosity, wetting ability and miscibility with water, and some very satisfactory results have, in fact, been obtained. The process of soil stabilization is nevertheless still very incompletely understood and much remains to be learned regarding the effect of the type of soil, grading, water content of the soil and type and proportion of binder, on the load carrying properties and durability of surfaces produced by this method. Developments in this connection may therefore be expected to have considerable influence on the properties of stable emulsions in the future.



**Left: Fig. 1, non-rising stem sluice gate.**

**Right: Fig. 2, sluice gate with rising stem.**

# How to Select and Specify Sluice Gates

**By H. L. BAKER**

ONE of the most important factors in the successful operation of a sluice gate is the selection of the type most suitable for the installation in question. There are over twenty types, each best suited for one particular set of conditions; and selection of an incorrect type may result in failure to operate at maximum efficiency. It is believed that a description of the various types and the uses to which each is best adapted will be helpful to engineers specifying sluice gates and to those purchasing and installing them.

### Non-Rising Stem or Rising Stem

We may divide all sluice gates into two general classes.These classes are: I—Non-rising stem (or self-contained), and II—Rising stem. These are shown in the classification outline herewith.

A non-rising stem sluice gate, Fig. 1, is a sluice gate wherein the stem does not move in a vertical direction. The gate is raised and lowered by the rotation of the stem which is threaded into a nut which nut is a part of the disc of the gate. The nut does not move in relation to the disc, the operation being similar to that of an inside screw gate valve. A sluice gate of this class can be a complete unit in itself requiring no additional appurtenances, such as extension stem or operating mechanism.

A rising stem sluice gate, Fig. 2, is a sluice gate wherein the stem is fastened rigidly to the disc of the sluice gate and does not rotate but rises and falls with the gate. The operation of the gate is effected by the vertical movement of the stem which is raised or lowered by a force applied to a lifting mechanism. This mechanism may be a nut (floor stand) which is rotated, causing the stem to rise; or it may be a hydraulic cylinder, causing the stem to rise because of water, air or oil pressure, being applied to the piston which is fastened to the upper end of the stem. An extension stem and some method of operation must be used. Fig. 2 shows a rising stem sluice gate with a section of the stem and without the operating mechanism.

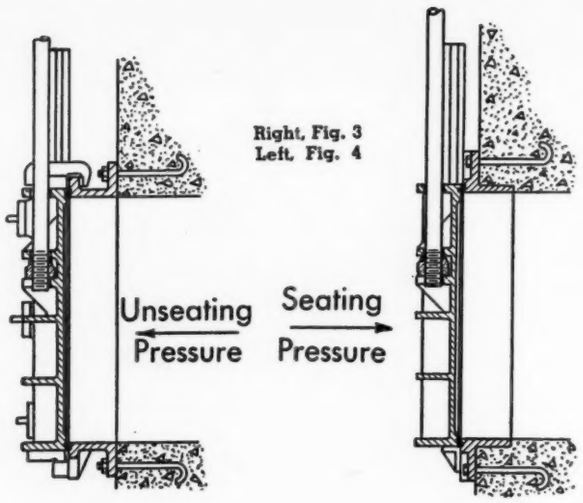
CLASSIFICATION OF SLUICE GATES

| I. Non-Rising Stem | | | | | II. Rising Stem | | | | |
|---|---|---|---|---|---|---|---|---|---|
| A. Circular | | | B. Rectangular | | A. Circular | | | B. Rectangular | |
| 2. Setting and Unseating Low Head (side wedges) | 3. Unseating (T, B & S wedges) | | 2. Setting and Unseating Low Head (side wedges) | 3. Unseating (T, B & S wedges) | 1. Seating (no wedges) | 2. Setting and Unseating Low Head (side wedges) | 3. Unseating (T, B & S wedges) | 1. Seating (no wedges) | 2. Setting and Unseating Low Head (side wedges) | 3. Unseating (T, B & S wedges) |

These can be furnished with flanged (flat) or spigot (flanged and spigot) frames or connections, see text. T, B & S means top, bottom and side wedges.

**Key to Sluice Gate Classification**

In choosing between these two general classes, it is necessary to consider the size of the gate, method of operation and the details of the installation, such as available space and headroom. Gates up to and including 42″ in size can satisfactorily be of either the non-rising stem or the rising stem class. Gates 48″ in size and larger should be of the rising stem class unless special conditions make this class of gate impossible or impractical.




A rising stem sluice gate requires an operating mechanism, which can be placed above the sluice gate at a point which is out of the water or other fluid, and which is usually accessible. This permits the threads and operating mechanism to be lubricated and serviced, if necessary, before or during the operation. The extension stem rising in the operating mechanism serves as an indicator to show the position of the disc; that is, it shows whether the disc is open, closed, or partly open. However, the extension stem on a rising stem gate will usually be larger than the extension stem for a non-rising stem gate of the same size, since with the former the extension stem must be capable of withstanding, without buckling, the entire thrust required for closing the gate.

A non-rising stem sluice gate is preferable for an installation requiring an extremely long extension stem. A considerable force is required for lifting the actual weight of the extension stem for rising stem gate, which force would not be required with a non-rising stem sluice gate.

Where an operating mechanism must be located at a point where the headroom above the mechanism is not sufficient to permit the stem to rise to the open position, it may be necessary to use a non-rising stem gate.

From the outline above, it can be seen that by the selection of one of the two general classes (I—Non-rising stem, II—Rising stem), approximately half of the twenty odd types of sluice gates have been eliminated.

### Shape of Opening; Working Pressure

The general class decided upon can be divided further into two groups, according to the shape of the opening through the sluice gate; namely, A—Circular, and B—Rectangular.

Circular opening sluice gates are used for attaching to circular pipes or circular channels or ducts. Rectangular opening sluice gates are used for attaching to walls, partitions or channels with rectangular openings.

By dividing the general classes of sluice gates (I—Non-rising stem or II—Rising stem) into one of the two groups just mentioned (A—Circular, or B—Rectangular), approximately three-fourths of the possible sluice gate types have been eliminated.

The next subdivision of the two groups just mentioned considers the actual working pressure to which the gate will be subjected. Working pressures on sluice gates are of two different directions. The pressure is either a "seating pressure" or an "unseating pressure." A "seating pressure" is a pressure which acts in such a direction as to tend to force the disc of the sluice gate against the seat or against the frame. This is shown in Fig. 3. An "unseating pressure" is a pressure which acts in such a direction as to tend to force the disc of the sluice gate away from the seat or away from the frame. This is as shown in Fig. 4. Therefore, consider the maximum (and in some cases, the minimum) unbalanced pressure to which the gate will be subjected, *and also* consider whether the pressure is a "seating pressure" or an "unseating pressure."

### Wedges

The pressure determines the necessity for wedges and the arrangement of the wedges. It may often be advisable to specify merely the pressure and permit the manufacturer to furnish the proper gate accordingly. However, the arrangement of the wedges can be decided upon if special care is given to the selection of the arrangement of wedges.

There are three types of sluice gates when considering wedges, each type being for a particular pressure. Type 1 in the outline herewith is the wedgeless type of gate and is shown in Fig. 5. Type 2 is the side wedge type of gate and is shown in Fig. 1. Type 3 is the top, bottom and side wedge type of gate and is shown in Fig. 2.

The wedgeless sluice gate (type 1) is used exclusively for gates subjected to seating pressures only, and with a head of at least 10 feet. If the sluice gate is required to be water-tight under any unseating pressure or under a seating pressure of less than 10 feet, then the sluice gate should be furnished with wedges. This is explained by the fact that a wedgeless gate depends entirely upon the pressure of the fluid to force the disc against the seat. Therefore, the pressure must be a seating pressure and must be of a magnitude great enough to force the disc tightly against the seat.

A wedgeless type of sluice gate is ordinarily not used for the non-rising stem class of gates or for the

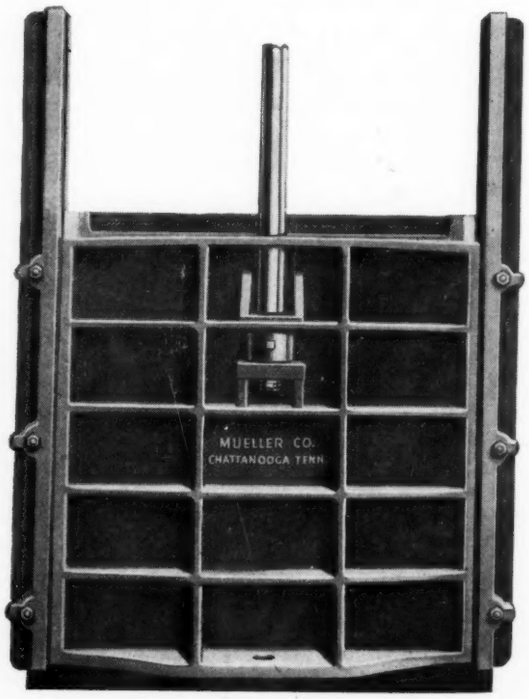



**Fig. 5. Wedgeless Gate**

sizes smaller than 18″. However, under certain conditions, a wedgeless gate of the non-rising stem class, or wedgeless gate smaller than 18″ might be suitable.

The sluice gate with side wedges (type 2) can be used for a seating pressure of any magnitude. If a sluice gate is required to be water-tight under all seating pressures, including heads less than 10 feet, then a side wedge sluice gate should be used.

A sluice gate with side wedges can also be used on installations wherein the sluice gate is subjected only to very low unseating pressures. This is especially true in installations not requiring absolute water-tightness.

Sluice gates with side wedges are used for unseating pressures on gates up to and including 18″ in width. It is difficult to apply top and bottom wedges to gates 18″ and less in width, but side wedges will satisfactorily seat such gates when subjected to a reasonable unseating pressure.

Sluice gates with top, bottom and side wedges (type 3) are used with both unseating and seating pressures. They are ordinarily furnished only in sizes 20″ in width and wider.

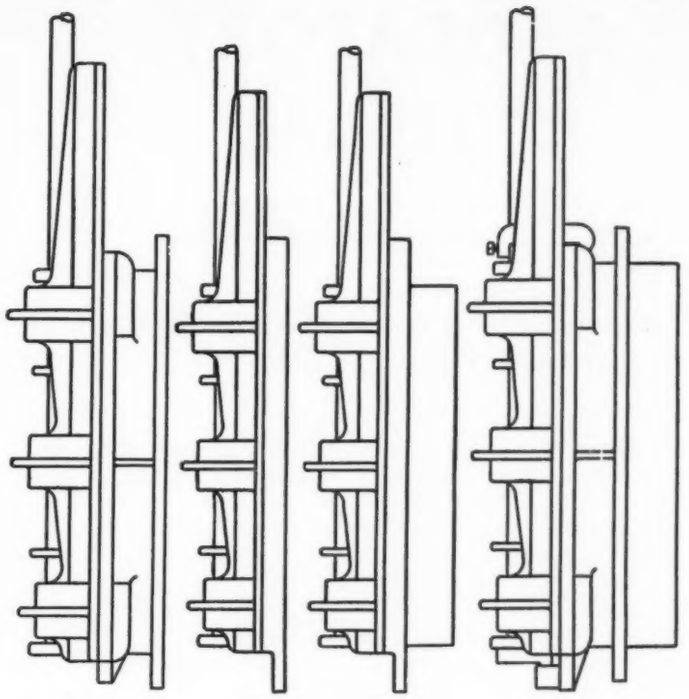


Fig. 6 Fig. 7 Fig. 8 Fig. 9

### Frames

Any of the combinations mentioned above can be used with one of two general kinds of frames or connections; namely, flanged (flat) or spigot (flanged and spigot). Flanged frames (Fig. 6) are ordinarily used for circular opening sluice gates bolted directly to the end of a pipe or to the end of a wall thimble. A flat frame (Fig. 7) which is really only one particular form of a flanged frame is ordinarily used on rectangular gates (without top or bottom wedges). Flanged frames are always used on gates with top and bottom wedges.

A spigot frame sluice gate (Fig. 8) is used for installing in concrete walls or partitions. This kind of a gate is held in place by anchor bolts. The flanged and spigot sluice gate (Fig. 9) is used on gate with top, bottom and side wedges.

### Appurtenances for Sluice Gates

In conjunction with the sluice gates mentioned above, other items are usually included, some of which are required and some are merely optional features.

Instead of the spigot (or the flanged and spigot) sluice gate just mentioned, a flat (or flanged) sluice gate which is bolted to a wall thimble, may be used. This permits the wall thimble to be bolted to the concrete forms and concrete poured around the wall thimble, thereby assuring a true, even surface to which to bolt the gate. The sluice gate is bolted to the wall thimble after the forms are removed.

Extension stems are always required with rising stem sluice gates and are often used with non-rising stem sluice gates. The extension stem is really a part of the operating stem on rising stem gates, while on non-rising stem gates it is merely a stem extension for elevating the point of operation above the sluice gate. The entire extension stem can be made of either steel or bronze, or the threaded section of the stem can be made of bronze with the balance of the stem made of steel.

The length of the stem should be indicated as the distance (1) from the center line of the gate to the base of the floor stand, or (2) from center line of gate to top of operating nut, or (3) from center line of gate to top of handwheel. Distances (2) and (3) will apply only to non-rising stem sluice gates without floor stands.

All rising stem sluice gates and some non-rising stem require an operating mechanism. This may be a floor stand, a bench stand, a hydraulic cylinder, or an electrically operated hoist. A non-rising stem floor stand or bench stand is, of course, only for use with non-rising stem sluice gates and is merely a guide or pedestal for the stem and handwheel.

Rising stem, non-geared floor stands or bench stands are usually made in two sizes. The smaller size is the plain bearing stand which is for use with small-size sluice gates. The larger size is the ball bearing stand for medium-sized sluice gates.

Floor stands for larger gates should, of course, be of the geared type. There are several types of geared stands, each type being for particular sizes of gates. Usually the geared stands are divided as follows: (1) bevel geared, single speed; (2) bevel and spur geared, two speed; (3) worm and spur gear, two speed; (4) extra-heavy duty, worm and spur gear, two speed. Geared stands are primarily for use with rising stem sluice gates, but can be used with non-rising stem gates.

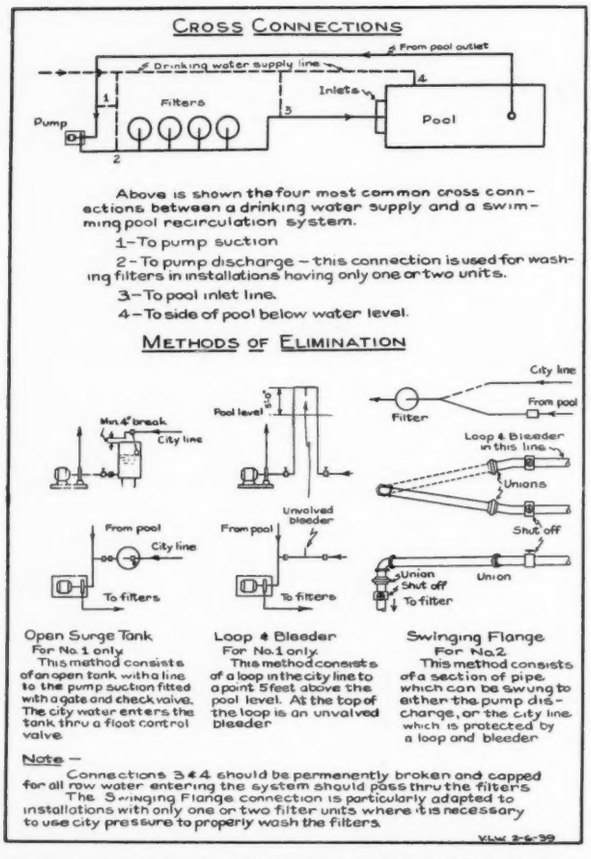
A hydraulic cylinder provides a very satisfactory means of operating a sluice gate. This permits the gate to be operated by a remote control and, in some cases, can be arranged for automatic operation. The hydraulic cylinder is either mounted on the floor or wall above the sluice gate, or directly to special guides or supports which form an integral part of the sluice gate, resulting in a complete unit.

An electrically operated hoist may provide the most satisfactory method of operating sluice gates, especially those of the larger sizes. Such hoists can readily be operated by remote control, or automatically, and a system of signal or indicator lights can be used in conjunction with them. Electrically operated hoists are usually supplied with handwheels to be used for emergency hand operation in the event of power failure.

# LABORATORY FIELD and OFFICE NOTES

## Effect of the Solubility of Glass on the Behavior of the Glass Electrode

The reported voltage departures of the glass electrode in (1) the majority of alkaline solutions above pH 8.5, (2) high concentrations of acid solutions, (3) concentrated salt solutions, (4) ethanol solutions and (5) for elevated temperatures have been studied by Donald Hubbard, Edgar H. Hamilton, and Alfred N. Finn in connection with the solubility of the glass customarily used for making glass electrodes. As reported in the *Journal of Research* for March, for every case investigated voltage departures of the glass electrode have been found to be accompanied by changes in the solubility of the glass.


CROSS CONNECTIONS
From pool outlet
Drinking water supply line
Filters
Inlets
Pump
Pool
Above is shown the four most common cross connections between a drinking water supply and a swimming pool recirculation system.
1–To pump suction
2–To pump discharge – this connection is used for washing filters in installations having only one or two units.
3–To pool inlet line.
4–To side of pool below water level.
METHODS OF ELIMINATION
Min. 4" break
City line
Pool level
Filter
From pool
Loop & Bleeder in this line
Unions
Unvalved bleeder
Shut off
To filters
Union
Union Shut off
To filter
Open Surge Tank
For No. 1 only
This method consists of an open tank with a line to the pump suction fitted with a gate and check valve. The city water enters the tank thru a float control valve
Loop & Bleeder
For No. 1 only
This method consists of a loop in the city line to a point 5 feet above the pool level. At the top of the loop is an unvalved bleeder
Swinging Flange
For No. 2
This method consists of a section of pipe which can be swung to either the pump discharge, or the city line which is protected by a loop and bleeder
Note –
Connections 3 & 4 should be permenently broken and capped for all raw water entering the system should pass thru the filters
The Swinging Flange connection is particularly adapted to installations with only one or two filter units where it is necessary to use city pressure to properly wash the filters.
V.L.W. 2-6-39

**The Illinois State Board of Health has published this sheet showing most common cross-connections between swimming pools and public water supplies.**

## Acute Water Shortage in Bermuda

Abnormally scant rainfall has left residents of Bermuda wholly dependent on rain for their water supply, facing the most serious shortage in years.

The scarcity reached the stage where the Director of Works issued an appeal to the population to give or sell to his department any surplus which individuals may have above what they need for their own use. In all churches, announcements were read telling where drinking water could be obtained free.

From the United States, 500 miles away, water has been imported by steamship, and many of the hotels are using only imported water. One hotel in Hamilton has been bringing in 400 tons a week.

Rainfall less than half of normal brought about Bermuda's plight. There are no streams or wells of fresh water on the group of coral islands. Rain is gathered in big tanks on the tops of the coral-stone houses and preserved carefully. For those who do not gather their own water, water peddlers go about the streets selling it at $1 a ton plus $3 an hour for cartage. But now most of the tanks are empty. Up till July 10th the Government had 795 applications for water, compared with 585 for all of last year.—*Canadian Municipal Review.*

## An 11,000-Foot Submarine Pipe Line

A line of 4½-inch pipe has been laid on the floor of San Francisco Bay from Oakland to Treasure Island, a distance of 11,000 feet, for bringing gas to the California World's Fair. It lies at an average depth of 50 ft. Forty-foot lengths of pipe were welded into 1,000 foot sections, floated and pulled out into the bay, than another section welded on; 2,000 ft. being taken from the Oakland side and 9,000 ft. from the Treasure Island side. The pipe was floated by steel drums spaced 40 ft. apart, and when the lines met in the bay they were welded together, forming one continuous line, the drums were cut free and the pipe allowed to sink. The work was done by the Pacific Bridge Co. for the Pacific Gas & Electric Co.

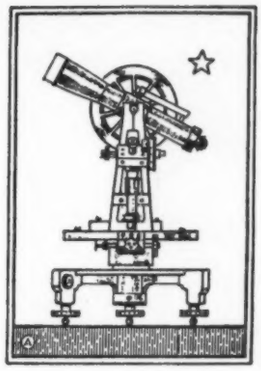
## Value of Water Produced by Georgia Public Supplies

In a recent check-up it was estimated that the total value of water as furnished to the citizens of Georgia through public water supplies during 1938 was $1,872,910. This figure is based upon an estimated population of 1,214,500 people being served by public supplies at the rate of 65 gallons per person per day and at the average value of $0.065 per 1000 gallons. Separate totals on filtered and ground waters were made with interesting results. A total of 17,876,787,500 gallons of water were furnished from filtered supplies to a population of 753,500 people at an estimated value of $1,161,991. Of the ground water supplies, a total of 10,937,225,000 gallons were furnished to a population of 461,000 people at a value of approximately $710,919.

To the total population of 1,214,500 people served by public supplies 28,814,012,500 gallons were furnished, with the previously mentioned value of $1,872,910.00.

| | *Number* | *Population (1930 Census)* | *Total Gallons Produced (Based on 65 g.p.c.d.)* | *Valuation (Based on $0.065/1000 Gals.)* |
|---|---|---|---|---|
| Supplies receiving both filtration and chlorination (including softening plants and iron removal plants) | 85 | 753,500 | 17,876,787,500 | $1,161,991.00 |
| Deep wells, shallow wells and springs, both chlorinated and unchlorinated | 260 | 461,000 | 10,937,225,000 | 710,919.00 |
| Total public water supplies | 345 | 1,214,500 | 28,814,012,500 | 1,872,910.00 |

# Massachusetts Surveys Provide Controls in Every Community



TWO geodetic surveys operating simultaneously in the state of Massachusetts—one a state-wide project, the other a high-accuracy city survey of the Boston area—are extending triangulation, traverse and levels from the established horizontal and vertical control positions of the United States Coast and Geodetic Survey's national system.

In effect, these surveys, in which the Works Progress Administration, the Coast and Geodetic Survey, the Boston City Planning Board, and the Massachusetts Department of Public Works are cooperating, are supplementing the twenty-five mile spacings of the federally established positions with closer stations, and running closed traverses for city and localized area purposes. Actually the work is far more comprehensive than that. The high accuracy, scope, and the implications of these surveys; along with their application to all city and regional development and to property values, make them of value not only to engineers but to all property owners and taxpayers in the state.

When completed, the Boston survey will establish in the city, a controlled net of horizontal and vertical reference stations and traverse lines which will make possible the accurate determination and preserving of the legal position of any street line, property boundary or physical object. These positions will be definable in terms of state-wide plane coordinates based upon the Lambert Grid system, which facilitate mapping and recording and which are better adapted to permanency, standardization and accuracy. Maps will be prepared on a scale of 40 feet to the inch, showing all street and property lines.

The state-wide survey is establishing a network of intervisible, permanently monumented geodetic control stations, in accessible locations at approximate intervals of two miles. The monuments will be easily recoverable by means of descriptions and surrounding reference marks. Plane coordinates (based on the Lambert system) also are being established in the state system.

Upon completion of this survey there will be established in every community fixed points of horizontal and vertical control. Whenever a city or town wishes to extend this work or make a net survey of its area, it will be done from these established positions and the use of assumed datums or references points will be eliminated.

At each of the established stations throughout the state and the city of Boston, the data available will include:

X and Y coordinates which define the position.
Grid azimuths to adjacent and other visible stations.
Grid distances to adjacent and other visible stations.
Direction angles to adjacent and other visible stations.
Elevation above mean sea level.

No assumed datums or origins are used in any part of this work. The Boston survey is tied in with and made an integral part of the State and Federal survey system, which is based upon the North American Datum. The use and adoption of plane coordinates, based upon the Lambert Grid projection, for Boston and the entire State is in accord with the latest scientific and engineering practice in precision surveys.

The procedures of the Boston City survey require that the resultant probable error in a measured base line be not more than 1 in 600,000; that the average triangle closure shall not exceed 1.5 seconds; that the average position closure of controlled first-order traverse after distribution of azimuth errors shall not exceed 1 in 35,000; the maximum not to exceed 1 in 20,000; that the average position closure of second-order traverse shall not exceed 1 in 15,000, the maximum not to exceed 1 in 10,000.

The triangulation net of Boston includes five first-order base lines and 65 stations. The area covered by this network is approximately 65 square miles. Beyond the periphery of this network, a band one-mile wide will still be within the control of the established stations, bringing the total controlled area covered by the survey to approximately 100 square miles. The controlled traverse will be confined to about 50 square miles of this area, with an average distribution of six linear miles of precise traverse to each square mile of territory. This will make a total of 300 miles of control traverse of first and second-order accuracy.

Extreme accuracy was obtained in the base line measurements. Three of these were measured with invar tapes in the daytime and two were measured at night with 50 meter steel tapes. Each base line was measured four times and the average probable error obtained was less than 1:1,000,000. The triangulation work, all of which was of first order, was accomplished with 10-second repeating theodolites, illuminated for night work. Seventy-five per cent of the triangulation was done at night. Ten-second repeating theodolites also were used for the traverse angle work, while the taping was done by the buck or tape-support method.

The accuracies and procedures of the state-wide survey are based upon the specifications for state and federal work of the Coast and Geodetic Survey. These require an average closure in length after adjustment on first-order triangulation not to exceed 1 in 25,000; second-order not to exceed 1 in 10,000. The procedure and accuracy for levels is the same in the city, state and federal work.

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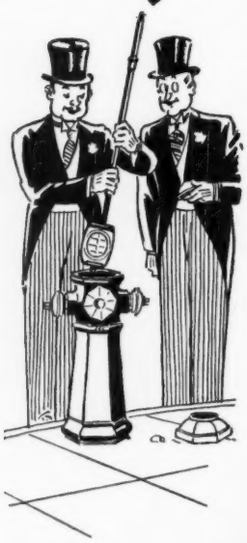

A hydrant must allow easy inspection and servicing. The *best* hydrant, therefore, permits the removal of *all* working parts as *one unit* by lifting stem through top of hydrant, *without unscrewing anything below the ground level.*

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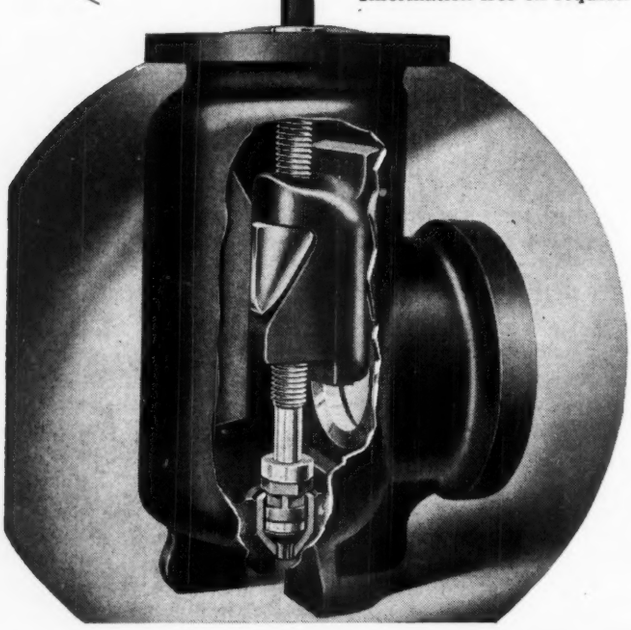

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## Water Main Construction Pollutes the Supply

A LARGE mid-west city treated in 1938 an average of 22,800,000 gals. of water, using averages of 20.56 pmm of aluminum sulphate, 0.88 ppm of liquid chlorine and 0.22 ppm of ammonium sulphate. Water is taken from the Mississippi river and passes through a reservoir, during which the turbidity dropped from an average of 9.7 ppm to 3.7, the 37° bacteria from 2650 to 715 per ml., the 20° bacteria from 1390 to 480, and the colon index from 4500 to 4.28. The colon index of the plant influent varied from a maximum of 14.55 in February to a minimum of 1.07 in June; that of the filter effluent from 2.72 in February to 0.12 in June, averaging 0.60 for the year. Chlorination reduced the index to 0 every month except April and June. In April 1236, 10 ml. tubes were incubated, and in June 2308 tubes, and colon recovered from one tube each month.

Samples drawn from the city taps, however, did not give so favorable results. The report of the Division of Water Purification says: "The samples analyzed from the city taps showed the presence of colon in comparatively large numbers in the summer months. However, the presence of colon bacteria in the city taps is not as bad as the data would indicate, because the contaminated areas were confined to isolated areas where new mains were in process of construction or vital repairs were made to existing mains. When the contaminated areas were discovered they were rapidly sterilized by the application of liquid chlorine to feeder mains leading through the contaminated area. A survey and study of the data of contamination in connection with necessary construction and repair work on the distribution system has led the writer to the opinion that contamination in the St. Paul water supply system comes as the result of such work activities. If contamination from work activity could be kept out of the mains, the water would reach the end of the mains with about the same bacteria content as the plant effluent. Repairs and new construction must be done, but such work should be followed with complete sterilization of all new installations before they are put into service as drinking water carriers."

The figures given in the report show average colon indices as follows: May 0.03 (62 samples); June 0.26 (48 samples); July 5.31 (132 samples); July 0.35 (80 samples). The city spent $23,596 for chemicals ($5,420 for liquid chlorine and ammonia) and delivered a colon-free effluent. Yet in July the carelessness in main construction resulted in such pollution of the supply that the average index of 132 samples was almost as high as that of the unfiltered coagulation basin effluent.

## Winter Clothing for a Standpipe

They have cold weather in Drumheller, Alberta, and know how to prepare for it. In building a 175,000-gal. ellipsoidal elevated tank, they enclosed both tank and riser with a frost casing which follows the contour of the structure at all points. There is, therefore, no detraction from the appearance of the tank and the casing is hardly noticeable even from short distances. The entire structure is painted aluminum except the balcony railing, which is black.

The tank is heated by means of a water jacket heater in a small building over the valve chamber at the foot of the riser. During the winter of 1937-8, when the temperature went as low as -50 deg. F., there was no ice in the tank at any time.

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## Larger Stop Signs Are More Effective

Investigation made by the Michigan Highway Planning Survey reveals that stop sign violations have been cut 50 to 75 per cent by increasing the size of the sign. Observations were made at an intersection south of Lansing, under the following conditions:

1—Use of old, weather-beaten and unreflectorized 24-inch signs.

2—New 24-inch reflectorized signs.

3—New 36-inch reflectorized signs.

A second set of observations was made for the 36-inch sign after a 30-day lapse in time.

Four thousand observations, equally divided night and day, showed these results: Violations were about the same for the 24-inch signs, and amounted to 8 per cent of motorists in the daytime and 17 per cent at night. When the new 36-inch sign was installed, however, violations dropped 50 per cent during the day and 75 per cent at night. Observers, suspecting that traffic was halted by the novelty of the sign, made further investigation in 30 days. Results this time showed a 70 per cent reduction in daylight violations and a 77 per cent reduction at night.

That these findings are of utmost importance may be realized by the fact that State police records in Michigan show that 25 per cent of all fatal accidents on trunklines during the past three years were right angle collisions at intersections. It would appear that this percentage might be reduced considerably by increasing the size of stop signs. At intersections where curves or other obstructions limit the driver's view of the stop signs, an advance warning sign of even larger dimenions may be installed.—*Highway Research Abstracts.*

## Soils for Engineering Purposes

Important actions were taken by ASTM Committee D-18 on Soils for Engineering Purposes at its sessions during Committee Week in Columbus, Ohio, March 6 to 10, notably the virtual completion of three tests covering soil-cement mixtures and one for soil stabilization with emulsified asphalt. The scope of this last named method involves the determination of absorption of soil specimens and the stability and shear resistance of the same specimens. After they have been subjected to the absorption test, the results obtained are used to determine the changes in soil properties produced by stabilization and to determine the efficiency of stabilization by resistance to plastic flow and to shear.

The three methods for soil-cement mixtures are designed for laboratory use. The first covers the determination of moisture-density relations and the scope indicates it determines the relation between moisture content of the mixtures and resultant densities (oven-dry weight per cu. ft.) when the mixtures are compacted in the laboratory before cement hydration in a manner similar to that achieved in the field with sheeps'-foot rollers operating on successive layers of loose material approximately 9 in. in thickness, so that the rollers are effective in compacting each layer from the bottom up.

The second method evaluates the durability of a soil-cement mixture of known composition by measuring soil losses, moisture changes, and volume change (swelling and shrinkage) produced by repeated freezing and thawing of specimens of known density and moisture content, comparable to density and moisture attained in the field with the same materials when compacted with sheeps'-foot rollers.

The third method determines durability by wetting and drying, instead of freezing and thawing.


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# Minneapolis and St. Paul* Sewer Rentals

**By Frank P. Bruce, Sanitary Engineer, City of Minneapolis, and Leonard N. Thompson, General Superintendent, Water Dept., City of St. Paul**

UNDER the Metropolitan sanitary district law passed by the legislature in 1933, the interceptor sewers and the disposal plant serving the cities of Minneapolis and St. Paul have been completed and put in operation. Under the terms of the law the annual costs for operation and maintenance are to be divided, until 1944, on the basis of approximately two-thirds for Minneapolis and one-third for St. Paul. After 1944 the apportionment is to be based on the total volume of sewage contributed by each city. Total annual costs, including fixed charges, have been computed at about $1,100,000, of which during this initial period Minneapolis is expected to raise $700,000 and St. Paul about $400,000.

The means of financing each city's share is left to the discretion of the governing body in each instance, it being the intention, of course, that a substantial portion of the necessary revenue should be derived from sewer rentals which the sanitary district law authorizes to be imposed.

The main differences between Minneapolis and St. Paul in sewer rental policy are two: First, Minneapolis relies more heavily on sewer rentals and less on general taxation than does St. Paul. Second, Minneapolis bases its sewer rental charge on water consumption while the St. Paul charge is based on the size of the water meter.

The general requirements as to sewer rental charges and the procedure for collection are set forth in a basic resolution adopted by the Sanitary District September 26, 1938.

### Minneapolis Sewer Rental Practice

Minneapolis sewer rental charges became effective July 1, 1938. The annual revenue from this source is designed to take care of the operation and maintainance costs, 60 per cent of the fixed charges on the treatment plant, and 30 per cent of the fixed charges on the intercepting sewers. The balance of the cost is to be raised by a one mill tax. The annual revenue estimates are roughly $480,000 from sewer rentals, $220,000 from taxes, or a total of $700,000.

Minneapolis has about 300 monthly accounts and about 93,000 quarterly accounts. The monthly accounts are those having artesian wells and those using over 100,000 cubic feet of city water per month. The quarterly accounts are all of the city water users using less than 100,000 cubic feet a month. For one or two-family homes, the winter quarter water consumption† is used as the basis for sewer rental charges. This is to eliminate the water used for sprinkling.

For quarterly accounts, or those using less than 100,000 cubic feet per month, the sewer rental rate is 2.8c per hundred cubic feet. Since the city water rate is 7.5c per 100 cubic feet, it is evident the sewer rental rate is an addition of 37 per cent to the water bill. The minimum quarterly sewer bill is 37c. For larger users, two additional brackets are provided in the sewer rental rate. The rate is as follows:

First 100,000 cu. ft. per month @ 2.8c per 100 cu. ft.
Next 200,000 cu. ft. per month @ 1.5c per 100 cu. ft.
Over 300,000 cu. ft. per month @ .75c per 100 cu. ft.

The smallest annual sewer rental charge will be $1.48 and the largest about $10,000. All properties abutting on streets having public sewers must pay rental charges even though sewer connections have not actually been made. In Minneapolis all city water meters are owned by the consumers. About 300 commercial and industrial establishments using artesian or river water have had to buy and install meters at their own expense as a basis for sewer rental charges. Deductions are made for water not reaching the sanitary sewer such as water used in product, evaporation, and clean water from cooling and air conditioning equipment which can be discharged into the storm sewer.

Rates to be charged outside of city consumers and municipalities have not yet been determined and are now being negotiated.

### St. Paul Sewer Rental Practice

St. Paul sewer rental charges became effective January 1, 1939, and are estimated to raise approximately $220,000 per year. The revenue estimated for 1939 is made up as follows:

| | |
|---|---|
| Estimate of St. Paul's portion of sanitary district costs | $168,949.00 |
| Estimate of cost to city of maintaining and operating St. Paul's portion of the interceptor sewers and pumping stations | 30,000.00 |
| Purchase of new equipment for the purpose of billing | 12,000.00 |
| Estimated annual cost of billing, etc. | 12,500.00 |
| Total | $223,449.00 |

The St. Paul sewer rental rates are based on the size of the water meter and are as follows:

| *Size of Meter* | *Annual Charges* |
|---|---|
| 5/8" | $ 2.40 |
| 3/4" | 4.00 |
| 1 " | 8.00 |
| 1 1/4" | 12.00 |
| 1 1/2" | 18.00 |
| 2 " | 36.00 |
| 3 " | 75.00 |
| 4 " | 180.00 |
| 6 " | 360.00 |
| 8 " | 630.00 |
| 10 " | 900.00 |
| 12 " | 1,350.00 |

*From "Minneapolis Municipalities."

†"Winter quarter" means "any three month billing period of the respective cities that falls between October 15th and April 15th following."

All accounts having meters over 1 inch in size, approximately 2,000 in number, will be billed monthly. Those having ⅝, ¾ and 1 inch meters will be billed quarterly. There are approximately 55,000 of these. On the basis of a survey of all the sewer accounts, the smallest account and, of course the most numerous, will involve a charge of $2.40 per year. The largest industrial account will involve a charge of something less than $5,000 per year. In St. Paul water meters are owned by the city but in the case of private water supplies the water consumers have to buy their own meters. Although there is no direct relationship between the sewer rental charges and the water consumption, it is anticipated that an actual record of water usage will be made.

The sewer rental revenue in St. Paul is designed to take care of only St. Paul's share of the operating costs of the Twin City district. The fixed charge portion of St. Paul's share of the Twin City district costs is to be raised through general taxation with an annual levy of approximately 1.5 mills.

In order that those outside of the city using the sewers may have no advantage over the citizens proper, the council has doubled the sewer rental charge (except in the City of West St. Paul which has its own sewer system), and has established a so-called service charge of $6.00 per year per connection which is in lieu of taxes. Exceptions are made, because of tax exemption, in the cases of the state fair grounds and the University farm campus.

## Reducing Explosion Hazards in Boston Manholes

An investigation of combustibles in manholes in Boston, Massachusetts, conducted by the Bureau of Mines, United States Department of the Interior, shows a marked reduction in explosion hazards.

Because of its interest in accident prevention, the Bureau of Mines cooperates with city and state officials and utilities in investigating the causes of explosions in sewers, manholes, tunnels, and other underground chambers and conduits and carries on investigations leading to the prevention of such explosions. The Bureau has cooperated since 1929 with public utilities in Boston, Massachusetts, for the purpose of identifying and elimnating combustible hazards in manholes in that city and surrounding territory.

A survey of the constituents present in manholes during the year in which the survey was made, showed two general types of contamination: (1) gases containing hydrogen, carbon monoxide, illuminants, and methane, usually due to manufactured gas that had found its way into manholes from leaks in gas mains and services, and (2) gases that contained abnormally high percentages of carbon dioxide, varying amounts of methane, and low percentages of oxygen, termed "soil" gases.

Contamination from more than one source was not uncommon, and often there was no sharp dividing line between the two classes of contamination. In previous years, gasoline and other hydrocarbons of a similar type were found in a few of the manhole atmospheres; however, during this survey none of these hydrocarbons was found.

The survey, which included tests in 16,353 manholes, has again demonstrated the value and necessity of cooperative, systematic, and continuous manhole testing to reduce the explosion hazards in such underground openings to a minimum, and has shown

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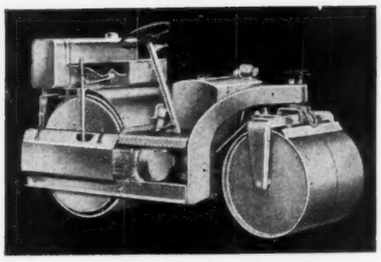

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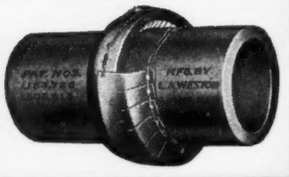

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that the detection, control, and elimination of combustible hazards in manholes can be obtained best by close cooperation of the interested parties.

The results of this survey are given in Report of Investigations 3433, "Investigations During 1937 of Combustibles in Manholes in Boston, Massachusetts," by G. W. Jones, John Campbell, F. M. Goodwin, and W. J. Huff, copies of which may be obtained from the Bureau of Mines, Washington, D. C.

## Destroying and Controlling Roadside Weeds

There are three ways to combat the yearly crops of unwanted vegetation which appear along roadsides and ditches and in parks, says the *Elbee Tatler,* house organ of Littleford Bros.: First—mowing with motorized mower or hand operated scythe; second, use of weed killing chemicals; third, weed burners.

When weeds are cut, it is only a temporary relief. Along North Carolina roads, for example, it is generally their custom to mow the road shoulders three times each season at a cost for labor, equipment, etc. of $3.50 per mile each trip. In some cases, mowing is the most desirable and economical procedure, as it keeps the road shoulders trimmed down, but when it comes to cleaning out drainage and irrigation ditches, rocky projections along right of ways, etc., the burning method is most desirable.

No figures are available as to the cost per foot or mile of using chemicals or burners, because this depends entirely on the type of weeds or foliage. Big heavy stalks take more chemical and more time than crab grass, short clover, etc. In general, here is the safest thing to say: "One weed burning torch will do as much in a day's time as five or six men could do by hand weeding." If the same number of workmen were all equipped with burner units, they would cover that much more territory than when weeding by hand. More taxpayers would then get the benefit of the work done over the greater mileage.

The biggest advantage of using a burner, however, is not the speed with which it does the work, but the results it gets. Instead of simply cutting off the tops of the weeds with other small shoots growing up in the same place, the extreme heat from the burners cooks the sap which backs down into the roots and splits open the ends, which leaves the weed entirely lifeless. This method burns seeds and all, thereby reducing the following season's crop of weeds.

Where it is necessary to cut weeds by hand or with a mower three times a year, it will only be necessary to burn them twice—the first time in June or July, and the second application of heat in the fall, as this will help burn up most of the seeds.

## Glass Curbs for English Roads

Glass curbs to mark the roadside have been used on 15 miles of highway in Essex and Leicestershire as a safety measure for driving at night or in fog. These new curbs, it is claimed, are easier to see than white painted curbs, the latter also requiring frequent repainting. The report from England states that experiments have been carried out with various reflecting materials, including colored cements. Eventually a new type of curb was designed, on the side of which are fitted panels of white vitrolite, a durable opaque glass with excellent reflecting qualities. Orders have been placed for applying this safety measure on extensive stretches of highway in other parts of the country.

# The Waterworks Digest

**Abstracts of the main features of all important articles dealing with waterworks and water purification that appeared in the previous month's periodicals.**

### Causes of Air-Trapped Mains

Almost anything that upsets the equilibrium of a poorly designed, constructed or maintained supply main may cause air trapping and the loss of flow and pressure. The major causes are: Locating a pipe where the hydraulic gradient falls below the pipe for any interval of time. Careless grading of pipe at critical points where the grade is very flat. Lack of air-relief valves and proper maintenance of same.[A82]

### Responsibility For Damages

In most states a water department is liable for damages due to negligence of its employees, the operation of the department being considered a proprietary function; while in all cases a private water company is so liable. However, use of a hydrant for fires or for flushing streets is a governmental function, but use for flushing the mains is not. In order to avoid negligence, the system must be laid with materials and in a manner that are considered standard good practice by the profession. Also precaution must be taken to prevent endangering the safety of any part of the system by acts of others, as by undermining or placing a load on a pipe. Failure to close valves promptly in case of a leak is negligence; present good practice requires that the maintenance gang have always at hand a list of valve locations, that there be a sufficient number of such valves, and that they be maintained in good condition. The courts are beginning to consider that furnishing unsafe water is of itself proof of negligence.[A83]

### Treatment Without Filtration in California

Many foothill communities in California use mountain water that is quite satisfactory except for occasional turbidity up to 600—1,000 ppm, and fairly safe, and is treated only by coagulation, sedimentation and chlorination, the added cost of filtration being considered not justified. At Sonora a drum screw is used, revolved by a paddle when in the canal from which the supply is drawn. Turbidity is reduced to 5 in Sonora, but may reach 20 or 30 in some supplies, and is kept at about 1 in Vallejo.[A89]

### Cincinnati's New Filter Plant

During 1936-38 Cincinnati, O., remodeled its 30-year-old filter plant at a cost of 3¼ million dollars. Capacity, 200 mgd with filters operating at 156 mgad. During the first 8 months operation the raw water averaged 6,300 coliform bacteria per 100 cc; the filter influent only 57; the unchlorinated filter effluent only 3; and the chlorinated effluent 0.22 coliform bacteria per 100 cc.—much greater reductions than any previous year.

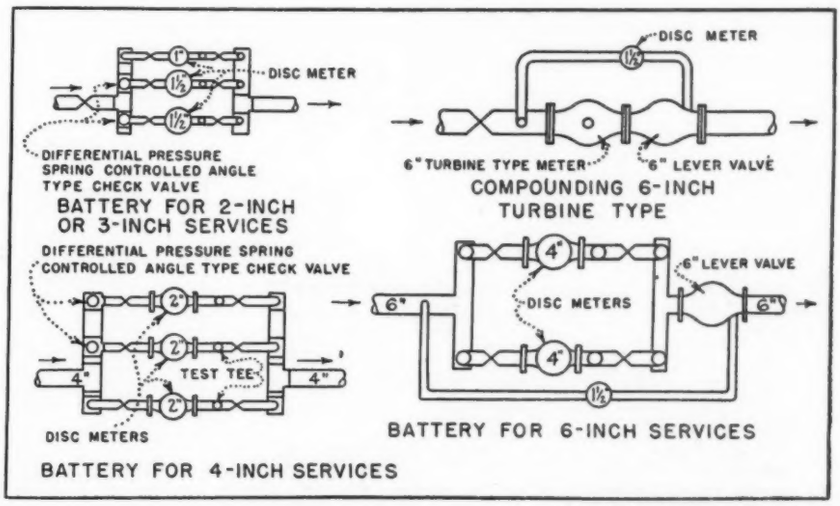
Lime, alum, iron sulphate and soda ash are unloaded by Brady pneumatic conveyors to 8 steel bins, feeding 8 Omega gravimetric feeders. In a separate room are two similar feeders for activated carbon. Chemical solutions pass through rubber hose to hydraulic jumps, then to 2 basins, each 175 ft. by 503 ft. In each basin the first 120 ft. contains 4 rows of Dorr flocculators; the next 350 ft. contains two traction-type Dorr clarifiers; the last 30 ft. contains a recarbonation chamber, provided with 4 rows of 2″ perforated transite laterals.

The river water averages 37 ppm alkalinity and 109 ppm total hardness, increased less than 5% by the treatment, and plans for water softening at present are in abeyance.

There are 40 filters, each 1400 sq. ft. sand area. Ammonia is fed into the filtered water as it leaves the filter and chlorine a few feet beyond.[F56]

### Battery Meter Installations

Louisville, Ky., installed two 6″ meters on a 6″ railroad service in 1890. By 1913 they had battery installations as follows: 6 6″ and 4 3″ on a 16″ service; 2 6″ on a 10″ service; 2 6″ on a 12″ service; 2 4″ on a 6″ service. Valves and test tees are installed for each meter. Later, on 3″ services, 2 2″ or 3 1½″ meters on 2″ services. All of these meters were in parallel and free to operate all at once. In 1933 it was thought desirable to so arrange that one meter would carry all the flow until its quantity was well above the minimum accurate rate of both meters combined. The plan employed since 1936 is to effect this change from one to both (or 3) meters by use of spring-controlled check valves—an angle-type in which the spring, when the flap is closed, operates a long lever arm to hold it shut, but when opened, the lever arm is decreased and little water pressure is required to hold it open and little head lost. Each meter has its individual test tee, and can be removed for repair or exchange.[A91]




Journal American Water Works Ass'n

**Typical arrangements of battery meter installations in Louisville.**

### Pipe Line Materials Compared

The principal distribution system pipe line materials are cast iron, steel and transite, which are used almost exclusively for sizes up to 24; with steel and reinforced concrete in general use for larger sizes. The cast iron is lined with cement, coal tar or bituminous enamel, with coal tar usually as an exterior coating; steel pipe with spun bituminous interior lining and bituminous enamel outside. More than 5,000 miles of cast iron is being laid a year, and about 600 miles of transite a year for two or three years past. Comparing cost of class 150 pipe laid in trench, for 6″ pipe transite is cheapest, steel pipe, uncoated next, then cast iron and coated steel highest. For 24″ pipe cast iron and transite are the same, steel cheaper. Assigning lives of 100 yrs. for cast iron, 75 yrs. for transite and coated steel and 35 yrs. for plain steel, the annual costs for 6″ are least for transite and greatest for steel either coated or uncoated. For 24″ pipe, cast iron is cheapest, coated steel next, then transite, then uncoated steel. In all sizes, transite shows least factor of safety, cast iron next, steel greatest.[A88]

## *Bibliography of Waterworks Literature*

***The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.***

*c.* Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

**A** *Journal, American Water Works Ass'n*

*June*

81. Construction and Use of Well Screens. By E. W. Bennison. p. 939-950.
82. Air-Trapped Water Supply Mains. By C. E. Elmendorf. Pp. 951-954.
83. Legal Aspects of Damages Occurring from Leaks. By P. Burgess. Pp. 955-968.
84. Administrative Problems of Preventing and Correcting Defective Plumbing. By A. H. Fletcher. Pp. 969-976.
85. Cross-Connection Elimination in Nashville. By R. L. Lawrence, Jr. Pp. 977-986.
86. Discussion on Plumbing Hazards. By A. R. McGonegal. Pp. 987-992.
87. *t.* The Voges-Proskauer and Methyl Red Reactions in the Coli-aerogenes Group. By R. Vaughn, N. B. Mitchell and M. Levine. Pp. 993-1001.
88. Adaptability of Various Pipe Line Materials in Water Main Construction. By L. R. Howson. Pp. 1002-1019.
89. Treatment by Coagulation and Sedimentation Without Filtration. By G. H. Bragg, H. B. Foster, Jr., and W. E. Wentworth. Pp. 1020-1032.
90. Symposium on Unusual Water Treatment Methods and Equipment. By F. R. Lauterbach, W. G. Curry, C. M. Pinkham, M. Edmiston, and H. C. Myers. Pp. 1033-1048.
91. Meter Settings and Controlled Compounding of Meter Batteries. By L. S. Vance. Pp. 1049-1055.

**D** *The Surveyor*

*June 30*

23. Water Filtration and Softening at Bolsover. Pp. 849-850.

*July 14*

24. Talybont Reservoir (and water purification). Pp. 35-37.

**E** *Engineering News-Record*

*July 6*

28. *p.* Chicago Filtration Plant Plans. By L. D. Gayton. P. 51.
29. Conduit Control Simply Solved. By C. R. Burky. Pp. 61-63.

*July 20*

30. Vacuum Frequency—The Measure of Hazard in Cross-Connections. By A. B. Cronkright and A. P. Miller. Pp. 64-65.

**F.** *Water Works Engineering*

*July 19*

55. Water Practices of Louisville. By N. N. Wolpert. Pp. 850.

*July 19*

56. 30-Year Old Filter Plant Remodeled (Cincinnati). By C. Bahlman. Pp. 916-920, 925.
57. Filter Plant Results at Covington. By N. N. Wolpert. Pp. 921-924.

**J** *American City*

*July*

17. Water Rates and Service Charges. Pp. 61-65.

**P** *Public Works*

*July*

31. Grouting to Prevent Leakage Around an Earth Dam. By J. F. Meisner. Pp. 12-14, 36.
32. Charges for Water Services Outside the City Limits. Pp. 27-28.

**T** *Technique Sanitaire et Municipale*

*May*

10. L'Esthetique Dans le Usines de Distribution d'Eau. By M. Pinset. Pp. 65-68.
11. L'Esthetique des Chateaux d'Eau. By A. Sayour. Pp. 71-79.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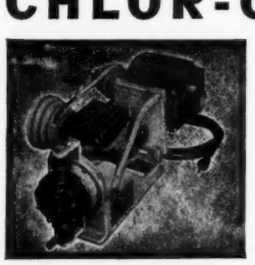

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# The Sewerage Digest

**A Digest of the Sewerage Literature of the Month giving the main features of all the important articles published**

### Fort Worth Trickling Filter Operation

During the four years 1935-'38, Fort Worth, Tex., has treated an average of 10,627,000 gpd of strong domestic sewage and partly treated packinghouse waste. The latter is not added during Sunday, and Monday's waste is about half that of the other 5 days. The population equivalents average 126,700 on Sunday, 188,000 Monday and 247,800 the other 5 days (based on 0.17 lb. B.O.D. per cap.). Four different treatment procedures were employed: A (for 582 days) Imhoff tank effluent direct to sprinkling filters. B (92 days) primary tank effluent direct to sprinkling filters. C (161 days) primary tank effluent aerated and placed directly on sprinkling filters. D (535 days) primary tank effluent aerated, passed through secondary settling tanks, then to filters. The 4.23 acres of filters had 8 ft. of 2.5"-1.25" hard limestone, sprinkling nozzle distribution. The preaeration was without sludge return; 0.43 cu. ft. of air per gallon, 5.5 hrs. aeration period during period C; 0.45 cu. ft. of air and 5.2 hrs. during period D.

Due to the packinghouse waste, there is a gradual falling off in quality of the filter effluent during the week and then a recuperating effect at the beginning of the next week. The B.O.D. removal during the four periods averaged 11.71 lb. per 1,000 cu. ft. during period A, 14.78 during B, 16.28 during C and 13.75 during D; or, in percentages, 80%, 81%, 85% and 90% respectively. During periods A and B there was some slight ponding, but none during C and D. The ppm of B.O.D. in influent and effluent respectively averaged 263 and 53 during period A, 270 and 52 during B, 288 and 46 during C, 242 and 25 during D. The filter effluent contained from 0.1 to 0.2 ppm of $H_2S$ during A and B, 0.2 to 0.3 during C and 0.1 to 0.2 during D.[C48]

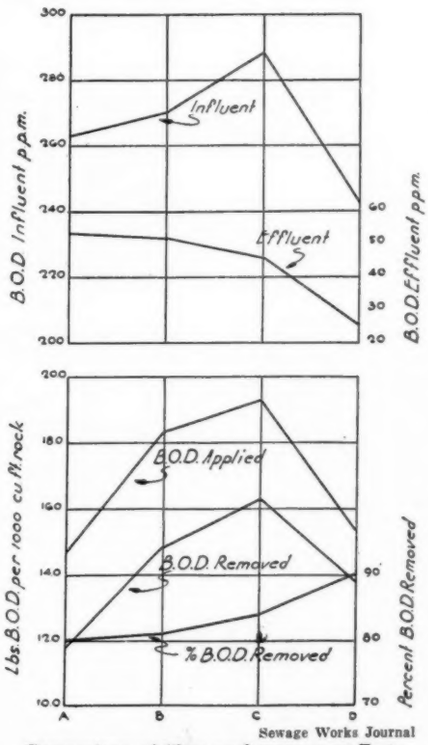
### Calculating Solids Removal

Solids removal calculated from sewage and effluent analyses may be so far from actual accomplishment that no dependability can be placed on such accounting, either as to efficiency of settling or in solids accounting. Although general practice is to base calculation of sedimentation tank performance on suspended solids removal, the author believes it should be based on total solids removal, as are sludge analyses. If suspended solids go into true solution, or pectization or peptization effects take place, they do not affect the total solids determination but do that of suspended solids.

Calculating average monthly solids by adding the individual solids determinations and dividing by their number, and average flow in the same way, and determining solids deposition on this basis, will not give correct results if some of the flows are abnormal. For precise work, either median values or weighted averages should be used.[C49]

### Overloading and Starving Activated Sludge

Experiments indicated that while sludge index and sludge ash are important criteria from the settling standpoint, they are very poor indices of change in biochemical quality of the sludge, as are also B.O.D. removal tests. A better index is the short-time oxygen utilization test; the quantity of oxygen used per grain of suspended solids during a short aeration period of the mixed liquor gradually increased with overloading of the sludge, and was slowly reduced with cessation of sewage feed to the mixed liquor maintained under continuous aeration. The substrate oxidation tests are sensitive indicators of change of biochemical quality of activated sludge, which property is gradually lost by either prolonged overloading or starvation. Prolonged aeration without food (sludge reaeration) altered the normal characteristics of activated sludge to the point where it lost entirely its ability to oxidize sewage substrates at high rates.[C43]




**Comparison of filter performance at Fort Worth.**

### Grit and Grease Removal at Indianapolis

At Indianapolis, Ind., during 1938 no trouble was experienced from eliminating two grit chambers, and a third was shortened by 50% and changed from continuous operation of mechanical cleaning to a few minutes' operation at 4-hour intervals. The washed grit is satisfactory for fill.

Grease skimmers are being installed in all the primary tanks. Skimmings are pumped to digestion lagoons. The average amount of skimmings for the year was 14.34 lb. mg, varying from 2.70 in November to 27.65 in April. Grit removed varied from 0.8 cu. ft. to 4.35 cu. ft. per mg, averaging 2.93.[C56]

### Optimum Conditions For Methane Production

The pH optimum for methane-producing organisms is at 7.0, dropping sharply each way from this. The optimum temperature is 28°C; neither rate of development nor ultimate number is affected by increasing the temperature up to 35°, and at 28° the ultimate number is the same but the time required is considerably longer. The concentration of the organic substrate (acetate, butyrate and ethyl alcohol) affects the maximum number of these organisms; the highest number is obtained with a concentration of 0.75 to

1.0%, dropping with either too low (0.1%) or too high (3.0%), concentration.[C44]

### Oxygen Utilization By Activated Sludges

Comparing sludges from four Wisconsin municipalities and mixing each with the four sewages, it appeared that when the same sludge was used with different sewages, approximately the same type of oxygen utilization curve was obtained with each; but if the same sewage was mixed with different sludges the curves were widely different. The magnitude of oxygen usage per unit of time was influenced by the strength of the sewage as measured by B.O.D. Oxygen utilization by activated sludges alone varied from 1.85 to 9.8 mg per hr. per gram of dry sludge; no relationship was found with content of suspended or volatile solids, but good correlation with percentage of ash or volatile solids.[C47]

### Sludge Gas Use Economical

At Green Bay, Wis., two sludge gas engines, one 90 hp, the other 120 hp, direct connected to an 80 kva and a 105 kva generator, have been operating for 10 months. These furnish power for operating the treatment plant, excess power being taken by the local power company, which also supplies any deficiency and the excitation current for the generators. The cost of the plant was $72,682 (including gas holder and compressors). The operating cost, including interest, depreciation, insurance, repairs, labor, etc., for the 10 mos. was $4,454; $3,295 was paid for power purchased, and the value of the power used was $8,861; leaving a net profit of $1,112.

The smaller engine operated 73% of the time at 102% loading, using 26.2 cu. ft. per kwh produced; the larger operated 24% of the time at 97% loading, using 27.5 cu. ft. of gas per kwh. Together they produced 456,700 kwh, of which 79,919 was given to the power company, from which 34,800 kwh was purchased for peak demands.[H38]

### Explosion-Proof Equipment For Sewage Gas Plant

The Wisconsin State electrical code required Green Bay to treat as hazardous the rooms containing sludge gas compressors, meters, drip pots, flame traps, pressure reducing valves and all high-pressure gas piping; in which rooms all the electrical equipment must be explosion-proof. Accordingly this equipment was separated from the rest of the building by a 12" solid brick wall, the only entrance being from the outside. The compressors are operated by explosion-proof motors started by mercoid switches enclosed in explosion-proof cases. To manually stop a compressor from the gas room there is an explosion-proof switch in the mercoid switch line. All lights are explosion-proof, operated by an explosion-proof switch. The gas holder recording pressure gauge was changed from electric drive clock mechanism to spring wound. The unit heater and exhaust air fan are operated by an explosion-proof motor manually controlled by an explosion-proof switch.[H38]

### Screen Filters At Niagara Falls

These filters (See "Sewerage Digest" for February, 1939), together with the rest of the Niagara Falls plant, were tested during 52 days under actual operating conditions with the full load for which the plant was designed—probably a unique test. In making the test 11,000 samples were taken, com-

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plete analyses made of 6,000, 40,000 meter readings were taken and nearly 100,000 computations made. A reduction of 99.99% of coliform bacteria was effected; 36.8% of the settleable solids removed, including all floating solids; the plant clarified up to 73 mgd (65 mgd was specified) and chlorinated up to 90 mgd; all sewage solids were destroyed by one of the two incinerators, and 73% of the filtering coke reclaimed.

Six coke-covered Riensch-Wurl type screens were furnished with a rated capacity of 8.33 mgd, but an average of 9.71 mgd was filtered during a 10-day concentrated test, and over 10 mgd average for the entire period. The coke used averaged 823 lb. per million gallons of sewage. The incinerators were operated to evaporate the water in the combined coke and sludge and burn all the sewage solids but as little of the coke as possible, thus recovering 73% of the coke for re-use. During the test 1.22″ of rain fell in 36 hrs. with snow on the ground, giving a flow to the plant of 90 mgd, of which 73 was screened and all disinfected. The power consumption for operating the screens was 3.8 kwh per mg of sewage treated, and that for the incinerators 3.7 kwh.[H37]

## *Bibliography of Sewerage Literature*

***The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.***

*c.* Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

C *Sewage Works Journal*
*May*

43. *t.* Changes in Characteristics of Activated Sludge Induced by Variations in Applied Load. By C. C. Ruchhoft and R. S. Smith. Pp. 409-425.
44. *t.* Development of a Method for Enumerating Methane-Producing Bacteria. By H. Heukelekian and B. Heinemann. Pp. 426-435.
45. *t.* Enumeration of Methane-Producing Bacteria in Digesting Sewage Solids. By Heukelekian and B. Heinemann. Pp. 436-444.
46. *t.* The Dissolved Oxygen Sag—An Analysis. By G. M. Fair. Pp. 445-461.
47. *t.* A Comparison of Oxygen Utilization by Activated Sludges Obtained from Four Wisconsin Municipalities. By C. N. Sawyer and M. S. Nichols. Pp. 462-471.
48. Trickling Filter Loadings at Fort Worth, Tex. By W. S. Mahlie. Pp. 472-479.
49. Solids Balancing. By G. E. Flower, C. B. Budd and C. Hauck. PP. 480-488.
50. The Sewerage of Delhi. By J. A. R. Bromage. Pp. 489-497.
51. Impounding Reservoir in Stream Purification With Respect to Sludge Bank Formation. By G. M. Ridenour and C. N. Henderson. Pp. 498-511.
52. Separation and Recovery of Paper Fibre From Waste Mill Water. By R. S. Hawley. Pp. 512-517.
53. Handling Paper Mill Waste in the Monroe Sewage Treatment Plant. by A. J. Kronbach. P. P. 518-521.
54. Three Years' Experience With Rating Sewage Treatment Works Operators' Annual Reports. By S. T. Barker. Pp. 522-523.
55. Revision of Rating Schedule for Rating Annual Reports by Operators of the New York State Sewage Works Ass'n By W. Donaldson, A. F. Dappert, and S. T. Barker. Pp. 524-542.
56. Excerpts from Annual Report of Sewage Disposal and Garbage Reduction at Indianapolis. By D. E. Bloodgood. Pp. 542-549.
57. Activated Sludge Research in the Laboratory. By F. W. Mohlman. Pp. 550-551.

D *The Surveyor*
*June 23*

33. Ventilation of Sewers. By L. B. Escritt. Pp. 815-816.

*July 7*

34. *p.* Conservancy Sanitation. (Air raid shelters, camps, etc.). By H. H. Clay. P. 25.

*July 14*

35. *p.* Investigation of Percolating Filters. By H. Wilson and E. J. Hamlin. Pp. 39-40.

E *Engineering News-Record*
*July 20*

17. A Brewery Waste Treatment Plant. Pp. 49-50.
18. Intercepting Devices for Sewers. By A. Wickesberg. Pp. 75-76.

H *Municipal Sanitation*
*July*

37. Niagara Falls Plant Passes Test. By W. Rudolfs. Pp. 348-350.
38. Economy in Sludge Gas Power Generation. By G. Martin. Pp. 351-352.
39. Ground Screenings and Washed Grit. By C. R. Velzy. Pp. 353-355.
40. Pollution and the Pocketbook. By S. G. Hess. Pp. 356-358.

J *American City*
12. Problems of Sewage Treatment. Pp. 57-59-66.

L *Civil Engineering*
*July*

5. Sewerage Works for Flood Protection at Springfield, Mass. By F. A. Marston. Pp. 409-411.

P *Public Works*
*July*

30. Sewage Treatment Investigations at Chicago. Pp. 10-11, 28-30.
31. Principles of Designing and Operating Activated Sludge Plants. By E. J. M. Berg. Pp. 20-26.

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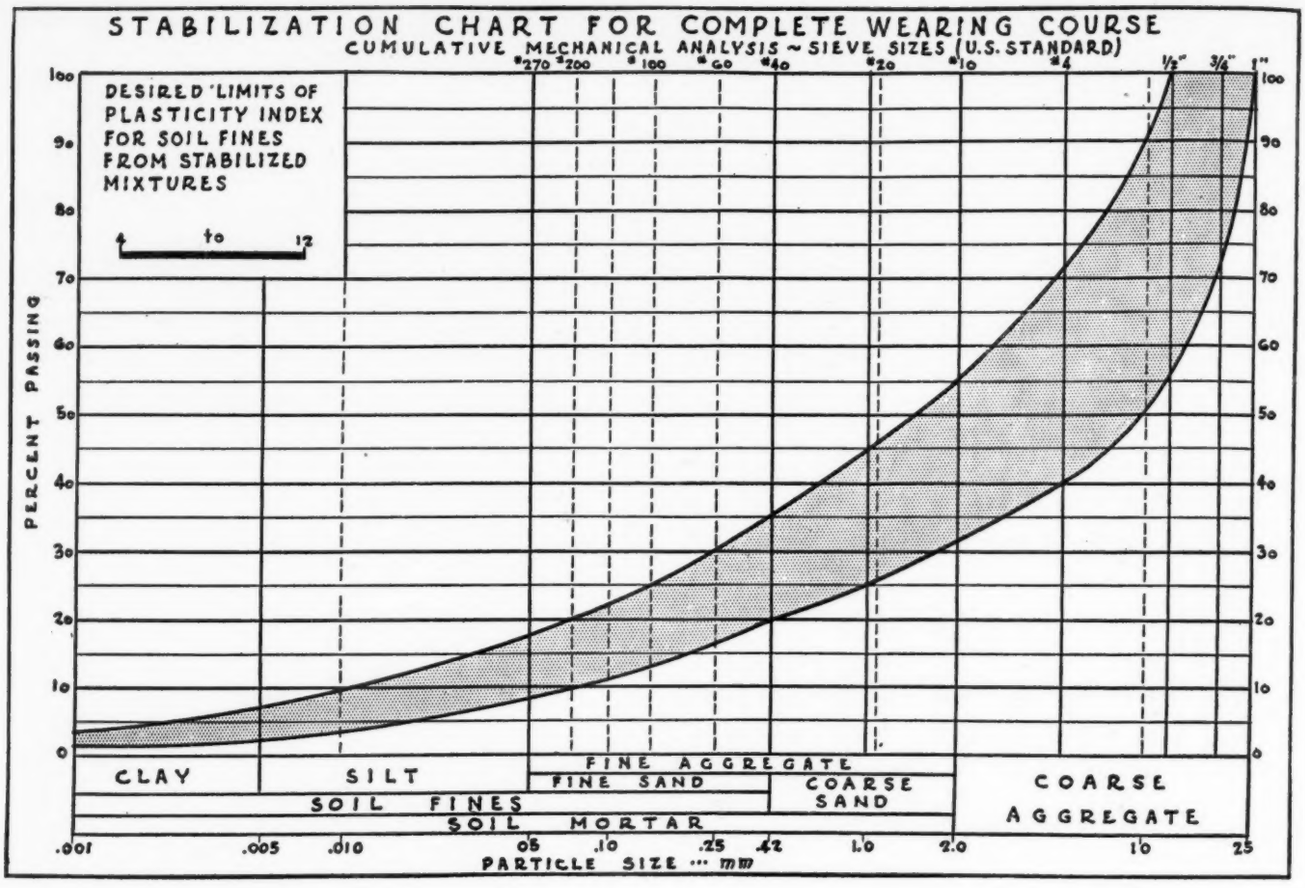
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4 to 12
PERCENT PASSING
100 90 80 70 60 50 40 30 20 10 0
CLAY
SILT
SOIL FINES
FINE AGGREGATE
FINE SAND
COARSE SAND
SOIL MORTAR
COARSE AGGREGATE
.001 .005 .010 .05 .10 .25 .42 1.0 2.0 10 25
PARTICLE SIZE ··· mm

# How to Maintain Highways and Streets

### Eighth Installment

## Maintenance of Stabilized Soil Road Surfaces

Stabilization is the term used to describe the careful and accurate proportioning of clay, silt, sand and gravel, or other coarse aggregate, so as to form the densest possible combination. The sand grains fill the space between the gravel or stone particles; and the silt and clay, in turn, fill the spaces between the sand grains. Moisture films or some substitute for them must be present in order to bind the soil particles together. Calcium chloride or salt is usually added to maintain these essential moisture films during dry periods.

In bituminous stabilization, the soil particles are waterproofed and bound together with tar or asphalt. Proper grading of the soil particles is not so important, since the bitumen coats the soil particles and waterproofs them, helping to fill the voids that are present. However, less bitumen is required if the soil particles are fairly well graded as to size, and it will often be economical to add coarse material to a fine soil, or fine material to a coarse sand in order to reduce the amount of bitumen needed to fill all of the voids.

### Constructing Stabilized Road Surfaces Using Calcium Chloride or Salt

A well designed stabilized mixture will contain 45% to 70% of coarse aggregate; 20% to 35% of fine aggregate; and 10% to 20% of binder soil. For the surface course, no particles of aggregate should be larger than 1-inch. For base course construction, aggregate up to 1½-inch size is permissible. Detailed information on the aggregate sizes, quantities, methods of sampling and other steps in the procedure necessary for designing and constructing surface of this type are available from the manufacturers of calcium chloride and salt.

The proportions required, as determined by screen tests, are mixed together with water to give the desired moisture content, and salt or calcium chloride is added. Mixing may be done on the road, in the same way as a bituminous road-mix surface, in a traveling plant, or in a stabilizer mixing plant. The aggregates may be all from the old road (if of the proper grading); all new material; or a mixture of the two in proper proportions.

In case the old road is used for all or part of the material, samples should be taken at intervals, especially where the character of the material changes, and these samples screened to determine whether fine or coarse material, and how much, must be added to obtain the proper mixture. In case all material is brought in, the aggregate can be obtained in the desired sizes and quantities, and the problem is a much simpler one.

The aggregate of which stabilized roads are composed may be mixed in place on the road. Where all or a considerable part of the material needed for the mixture is provided by the old road, this procedure is usually desirable. If any additional material is required (which is usually the case), this is spread on the scarified surface of the old road, and the entire mass mixed thoroughly with motor maintainers, special mixers or blade graders. It is then wetted,

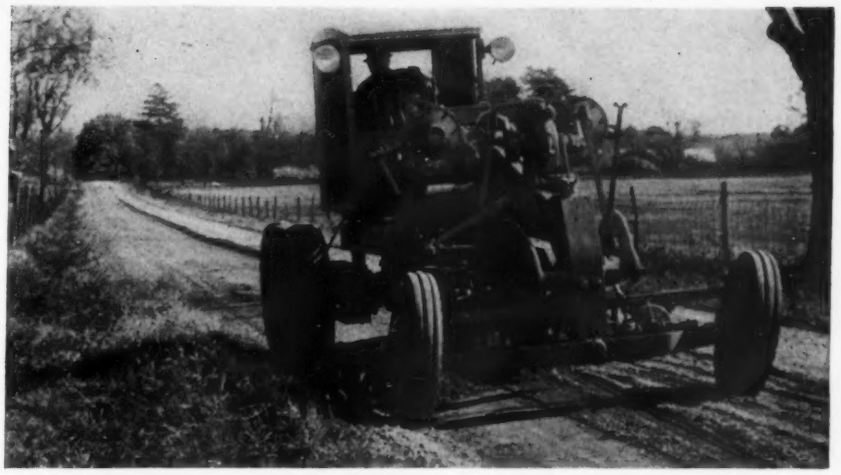
treated with chemical, spread, shaped and compacted.

Where all of the material must be brought in, stabilizer mixing plants may be set up at a central location, and the materials brought to them for mixing. These plants will produce a dry mix, or a wet mix, or a wet mix to which the necessary amount of chemical has been added. The ready-mixed material is hauled to the road, spread, shaped; and if water and chemical has not been added, this is done; and the surface compacted.

In roads of this type, the function of the chemical is an important one. So long as a stabilized road is kept damp, it is very resistant to raveling, breaking and wear; but when it dries out the bond between the soil particles is no longer sufficiently strong to prevent surface breaks under traffic. Both calcium chloride and salt have the property of absorbing moisture from the air, or during rainy periods, and of yielding this moisture very slowly through evaporation. The presence of these chemicals, therefore, in the stabilized layer, is necessary to maintain it in the damp condition essential to good service.

## Maintenance of Chemically Stabilized Surfaces

The maintenance procedures for chemically stabilized roads include blading, providing and maintaining the moisture bond and patching. Proper drainage is important. Experience indicates that a crown of at least ½ inch per foot should be maintained in order that roads of this type give the best service. Experience has also shown that a flat A crown is more satisfactory than the usual circular crown. The latter, on roads of this type, give an area in the middle of the road that is too flat for adequate drainage of the surface.



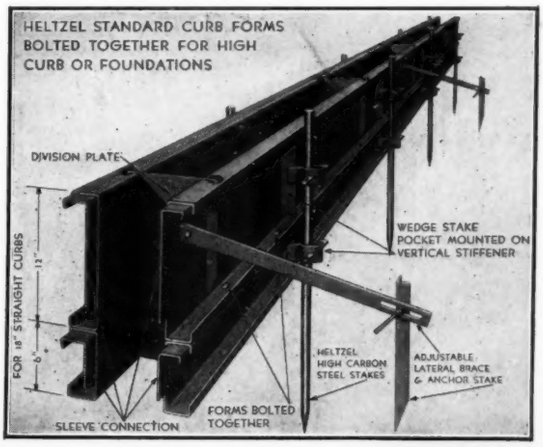
**Motor grader maintaining gravel road at a rate of 6 miles per hour**

*Blading.*—Much less blading is required for proper maintenance of the stabilized surface than is required for the ordinary gravel surface that normally carries a loose mulch or floating cover on it. The blading of the stabilized surface, however, must be done only at the proper time. Work of this type should not be done in dry weather or after very light rains.

Small holes and corrugations can be removed by blading with a grader or maintainer while the surface is wet enough to be workable, but with no free water present. If the correction of these defects is attempted by blading during dry weather, the surface is apt to be torn and disturbed by the blade, producing an excess of loose or floating material. Also, disturbance of the surface during dry weather tends to dissipate the chemical solution, which in dry weather is close to the surface of the road.

Therefore, blading for correction of defects should be confined to periods when the road surface is wet; and during dry weather maintenance should be limited to keeping the surface free from loose floating aggregate, which may abrade the surface under traffic.

When the surface is thoroughly wetted, blading and smoothing of a stabilized road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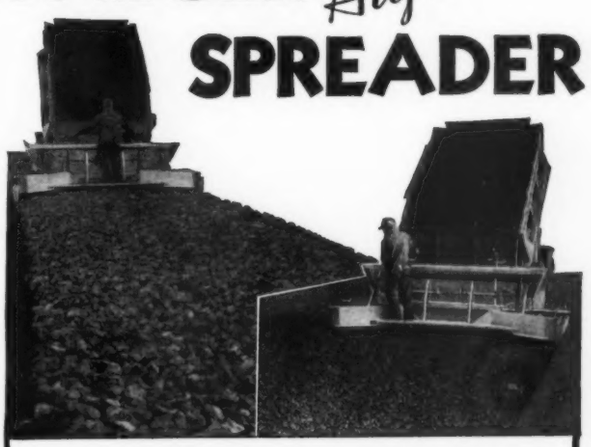

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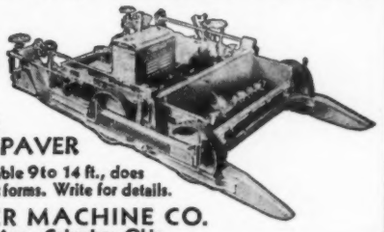

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is easier and results in less loss of chemical; also, there is sufficient moisture in the material that is shaved off by the blade, or loosened, so that this material can be bound back into, and become a part of the surface of the road by the action of traffic. As the surface dries out after a rain, it becomes so hard that proper manipulation is impossible.

Heavy rains may wash some of the binder soil from the road surface toward or to the shoulders, leaving the surface loose or improperly bound, so that it will ravel or break under traffic. If this binder soil is available to the blade, it should be brought back to and spread over the road while in a moist condition; or if the shoulders contain suitable clay, silt or loam, this may be utilized to replace that lost. Small windrows of aggregate may be placed along the sides of the road and bladed in when, as and if needed.

In scheduling blading operations, advantage should be taken of rains; frequent inspections of the road will show where maintenance is most seriously needed, and will also be a guide for the placement or furnishing of aggregate or binder soil to meet the needs of maintenance.

In connection with this section, read the material on gravel road maintenance in the April, 1939, issue, especially that portion that relates to maintenance by semi-stabilization.

*Maintaining the Moisture Bond.*—The information in this section and in the following one is based on directions issued by the Calcium Chloride Association[8], but these also apply generally to the use of salt.

To prevent raveling and breaking of the surface, and to maintain stability, it is of course necessary to keep the mixture in a damp condition. This is accomplished by periodic applications of the chemical, at such intervals as will prevent the road from becoming thoroughly dried out. About two pounds of calcium chloride per square yard per year will be required. The usual practice is to apply one pound per sq. yd. early in the summer, when the road still contains moisture from the spring rains. This is followed by two aplications of ½ pound each later in the summer, at such intervals as may be required to maintain the proper moisture content. This will depend upon weather conditions. The best time for applying the chemical is following a rain and after necessary blading and patching operations have been completed.

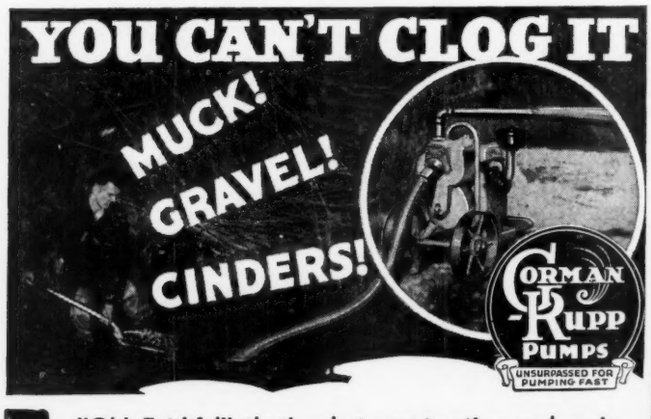
The chemical should be spread evenly over the road, preferably using a drill type distributor, which should spread evenly and not in small windrows. Most of these cover only about half of the road. A slight overlapping in the center is not harmful and may be desirable.

A heavy rain just after application of the chemical will wash some of it away; therefore, this should be avoided, if it is possible to predict the weather. If rains do not occur for long periods, and it is considered necessary to apply the chemical to preserve the road surface, this may be done at night, when more moisture is usually available for absorption, or the road may be heavily sprinkled before applying the chemical.

*Patching.* — During prolonged dry spells, holes may develop in the surface of a stabilized road, especially if there is considerable traffic. These holes should be patched with a mixture of sand-clay and graded aggregate, the aggregate particles being under ½-inch in size. Use equal parts of each; add from 6% to 10% by weight of water; and 100 to 150 pounds per cubic yard, (4 to 5½ pounds per cubic foot) of calcium chloride. This may be mixed by hand, but it is preferable to use a small concrete mixer. If desired, this can be mixed dry, and the water added while patching.

As already stated, raveling and potholing is most serious and rapid in dry weather, and necessary repairs should be carried out promptly.

*Shoulder Construction and Maintenance.*—Stabilized mixtures form excellent material for constructing shoulders. The procedure in construction is as follows: Excavate along the edge of the road to the desired width, and to a depth of 4 to 6 inches. A width of 2 or 3 feet along each side is usually sufficient, and operations should be carried on one side at a time to prevent undue interference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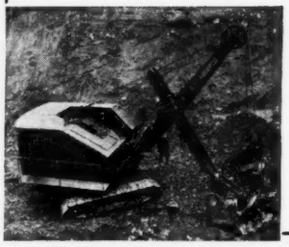

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with traffic. Prepare a stabilized mixture according to the requirements already given, adding calcium chloride to the amount of 18 to 20 pounds per cubic yard. This mixture can be mixed on the road and then bladed into the shoulder excavation; prepared at a central mixing plant; or mixed in a concrete mixer. After placing, the mixture should be well compacted. A trench roller, or a narrow gauge roller is preferable; where these are not available a truck can be used, with one wheel on the road and the other on the freshly laid material. After compaction, spread a light application of chloride on the surface—about ½ pound per square yard.

Such stabilized shoulders need to be bladed two or three times a year—always when they are properly moist. Also, two or three surface applications of calcium chloride will be needed per year, using about ½ pound per square yard per application. Potholes in the shoulder should be patched with a mixture similar to that used in original construction.

### Bituminous Stabilization

In planning bituminous stabilization, five factors [10, 11] must be determined. These are: Depth of stabilized foundation, which depends on subgrade, drainage conditions and type of soil; amount of aggregate to be added, if any; grade of bituminous material to be used; amount of bituminous material; and the moisture content of the soil at which it compacts best. A laboratory examination is needed to determine these factors. In practice, complications result from the fact that soil types change, from place to place along the road, and allowance must be made for these.

Procedure in construction includes loosening the soil, adding aggregate, pulverizing, adding water if necessary, adding bituminous material, mixing, compacting, rolling and after a curing period applying the seal coat. These steps in procedure will vary slightly with the bituminous materials used. The question of adding aggregate is primarily a financial one, in that less bituminous material will be required, as a rule, if the soil is fairly well graded and contains fine, medium and coarser particles. If the cost of adding aggregate is greater than the cost of the extra bituminous material, no advantage will be gained for it.

The detail steps in procedure should follow the recommendations of the manufacturer of the bituminous material. Most of the larger makers maintain laboratory service which is available for designing the mixture.

A bituminous stabilized road is, in reality, only a base. A wearing course must be placed on this base in order to give good service. Generally, the road should be allowed to cure for two weeks or more before the surface is applied. This wearing surface may be a surface treatment, a heavy seal coat, a retread or road-mix, an asphaltic limestone or rock asphalt surface, as required by the traffic using the road.

*Maintenance.* — Maintenance of bituminous stabilized roads will follow the ordinary procedures for any bituminous surfaced road. The wearing surface must be kept intact; breaks in the base repaired; proper drainage maintained; and the wearing surface renewed from time to time. The directions already given for the type of surface should be followed.

**The Barber-Greene Mixer will supply stabilized material for either construction or maintenance.**

### Reference Data

[8]Specifications, Design of Mixtures, Construction and Maintenance. Bull. 25, Calcium Chloride Assn., Detroit, Mich.

[9]International Salt Co., Ithaca, N. Y.

[10]Soil Stabilization with Tarvia, Barrett Co., 40 Rector St., N. Y., N. Y.

[11]Soil Stabilization with Asphalt, C. S. 40, Asphalt Institute, N. Y., N. Y.

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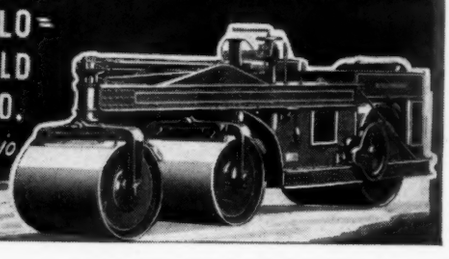

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# What to Do When the Trickling Filter Ponds

PRECEDING the spring sloughing, the filter may accumulate a considerable load of sewage solids which may be serious enough to cause ponding or pooling at the filter surface. Other causes of ponding may be the presence of a heavy growth of algae or fungi on the filter stones. It may also be due to improper gradation of filter rock, to the use of rock having too rough a surface or to the disintegration or spalling of the rock.

Usually ponding is caused by the clogging of the top layers of rock rather than by clogging at the bottom of the filter, although underdrains may become plugged up if they are not flushed out periodically. The top layers of stone bear most of the load since the rate of purification is constant and the top layers receive the strongest sewage. The elimination of ponding is essential if the trickling filter is to be expected to do a good job. A ponding filter is not efficient.

Ponding caused by spalling of the rock, too great a variation in size of the rock or rock having very rough surfaces necessitates that the defects in the material be remedied. These faults were incorporated in the plant.

Ponding that is caused by the ordinary gelatinous growth and suspended solids from the sewage may be eliminated by one of several methods. There is no standard cure, as the character of the growth or deposits depends upon the type and strength of waste treated and the degree of primary treatment. Some methods that have been recommended by engineers and operators and have been proved satisfactory at various plants are as follows:

1. Flush the surface of the filter with a fire hose.
2. Rake, fork or scarify the surface of the filter bed.
3. Punch holes through the top layer of the filtering material with an iron bar, spacing closely.
4. Apply chlorine (chlorinated lime may be used) for short periods to the filter influent at the dosing tanks or directly on the filter bed surface.
5. Cut the ponded filter out of service for 12 to 48 hours except during freezing weather.
6. Flood the filter.

The first three methods deal with the top layer of the filter, the principal object being to eliminate the plugging of the voids in the rock mechanically. Filters will not pond if they are kept clean and the cleaning way may be accomplished by one of these methods.

The ponding may also be eliminated by chlorinating the liquid before it is applied to the filters. Generally the sewage going on to the filters has a high chlorine demand and, in order to obtain a residual chlorine high enough to kill the organisms causing the ponding, a relatively high dose is required. For this reason many operators apply chlorine at night when the sewage flow is weak and the strength is much less than during periods of greater flow. At night less chlorine is necessary to obtain the desired residual which should be from 0.5 to 1.0 ppm at the nozzles or distributors. Chlorination should be continued periodically until the offending material has been sloughed off. Too great a chlorine dose should not be applied because the gelatinous growth should not be completely removed from the filter.

When a filter is ponding it is sometimes possible to make it slough by cutting out the filter or a portion of the filter and allowing it to dry out for 12 to 48 hours. When the filter is put back into service it may slough a good share of the offending growth. The material merely dries up and is then washed off when the filter it put back into operation.

The last method listed consists of flooding the filter and allowing water or sewage to stand covering the rock for a period of 12 to 18 hours. This may loosen up the growth allowing it to be flushed out when the filter outlet is opened and the bed put back into operation. This method is also suggested for the control of filter flies.

If one method is tried and fails, another may be tried. Possibly a combination of several methods may be required to do the job. Other routine matters which should be attended to are the regular cleaning of nozzles and the periodic flushing of underdrains. If large particles of solid matter are going over to the filters from the primary tanks, it may be necessary to put in a fine screen ahead of the dosing tank. Regular or continuous removal of scum from primary tanks is also necessary to prevent this material from being discharged on the filters or from stopping up the nozzles or siphons.

Improvement of filter efficiency may sometimes be obtained by increasing the rate of application of sewage to the filter. This may necessitate cutting out a portion of the filters permanently or cutting down the size of the dosing tank so that the filters are dosed more often and for shorter periods of time.

The principal point to remember is that filters, especially the top layer, should be kept clean in order to prevent ponding and to maintain their efficiency.—*The South Dakota Clarifier.*

**The Everson Manufacturing Co. held a dinner recently for its staff. Mr. Everson is fifth from left in the second row.**

# Keeping Up With New Equipment

Jacobsen new model power mower.

## "Royer Jr." Compost Mixer, Aerator and Loader

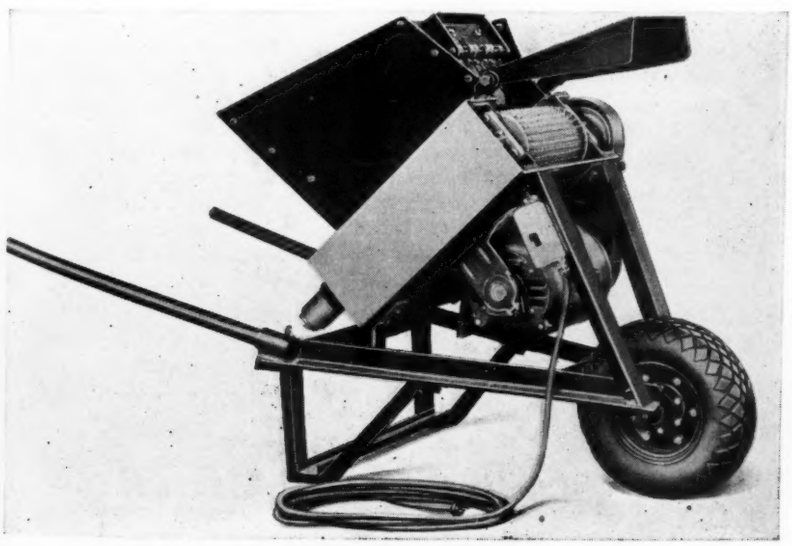
A light-weight, readily portable, low cost compost shredder-mixer-loader, has been announced by the Royer Foundry & Machine Company of Kingston, Pa., for use by sewage treatment plant operators. This has been redesigned to reduce the cost and lower the weight.

Capacity per hour is as much as one man can shovel—3 to 4 cu. yds.—and low shoveling height, plus controlled direction of discharge of shredded material, are design features. The unit is mounted on a single pneumatic tire, and is easily wheeled about by one man, having a net weight of only 270 pounds. Complete details on the new "Royer Jr." are available from the manufacturer.

## New Jacobsen Power Highway Mower

Jacobsen Mfg. Co., Racine, Wisconsin, has announced its new improved motor scythe for park, golf course and highway maintenance.

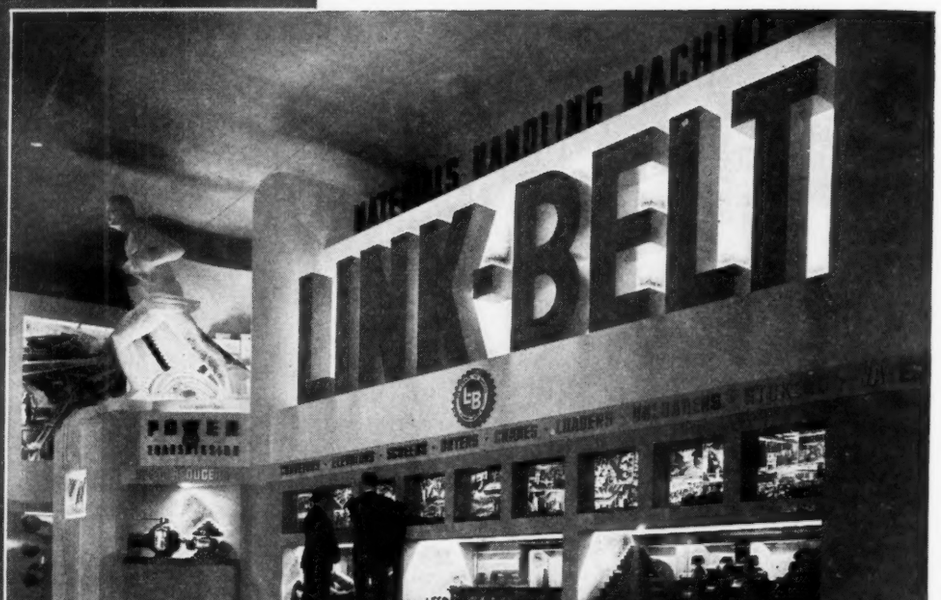
Equipped with a 4-foot sickle bar and powered by a specially-built 2 H.P. Jacobsen engine, the mower has a capacity equal to seven men with hand scythes and will cut through the tallest grass and toughest weeds. It has an auto-type differential and separate sickle and traction clutches. It cuts as low as 1½" and as high as 5½". It has the power and flexibility to work with equal efficiency on uneven ground, along ditches, hillsides and other hard-to-get-at places. Folder and specifications on request.

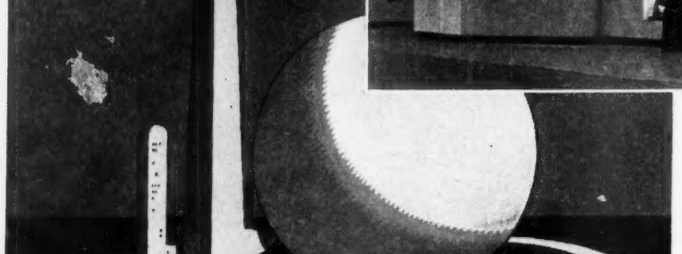


The small Royer shredder is fine for grinding sludge.

A circular saw cuts out a piece of Armco corrugated pipe, permitting installation of a standard sewer pipe connection.

# FOR ALL TO SEE!



**NEW YORK WORLD'S FAIR 1939**

*Main Exhibit*

**METALS BUILDING**
**(OPPOSITE TRYLON)**

●

*Stoker Exhibit*

**HOME BLDG. CENTER**

● Millions of people who visit the New York World's Fair, will gain a new insight into the benefits of mechanical handling and power transmitting from what they see and hear at the Link-Belt exhibit.

With so many things to occupy our time these days, too much is taken for granted. We accept ever-lower prices on ever-better commodities in ever-increasing number, as a matter of course... seldom giving a thought to the reason why our hours of work will buy so much of life's necessities and pleasures.

Probably no other manufacturer of mechanical equipment is better qualified to tell this story. Progressive management in every industry from Maine to California — from Minnesota to Florida, is using Link-Belt equipment to multiply the value of individual endeavor. And for more than 60 years, Link-Belt has worked hand-in-hand with the men and women in industry who have made America the envy of the world.

American Industry and American business brains have found the way to pay better wages... to work shorter hours... to pay more for raw-stuff... and still, with the help of mass-production and mass-distribution, to give our people what they want... at prices they can pay. 7819-B

**LINK-BELT COMPANY**
Philadelphia Chicago Indianapolis San Francisco
Atlanta Offices in Principal Cities Toronto

# MACHINERY *Points the Way to Better Living*●

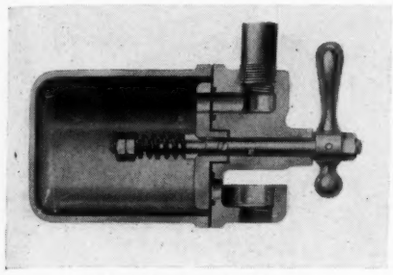
***While in New York see Link-Belt equipment in operation at the Tallmans' Island and Ward's Island Sewage Treatment Plants***


When you need special information—consult the *classified* READER'S SERVICE DEPT., pages 46 to 49

## New P.F.T. Condensate Trap

This new development is claimed to be a positively sealed moisture trap for removing small quantities of moisture from gas lines without any of the attendant hazards of gas leakage. It is simple in design, foolproof and manually operated.

In a normal installation, the moisture



PFT Condensate Trap

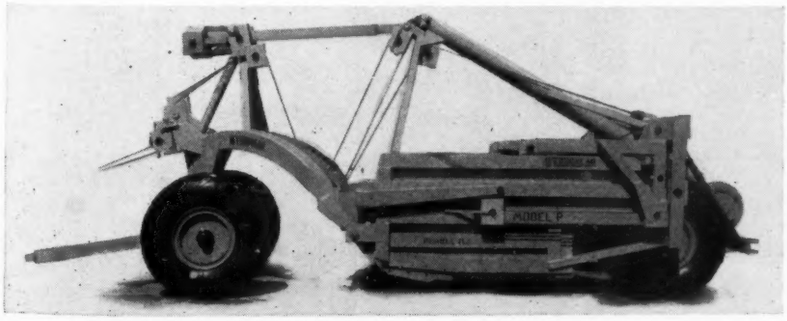
from the sewage treatment gas line drains into the trap which is placed at the lowest point in the line. Periodically the collected moisture is drained off by manually turning the operating handle a half turn, 180 degrees. This operation positively closes the gas line connection before opening the drain, making it impossible for any gas leakage. After drainage is completed, a half turn of the operating handle cuts into the gas line again for continued operation.

The P.F.T. Condensate Trap is furnished with 1" pipe thread and with a reservoir of approximately two quart capacity. All parts of the trap proper are aluminum castings. Details of construction are as shown in the sectional view which also shows the simplicity of design.

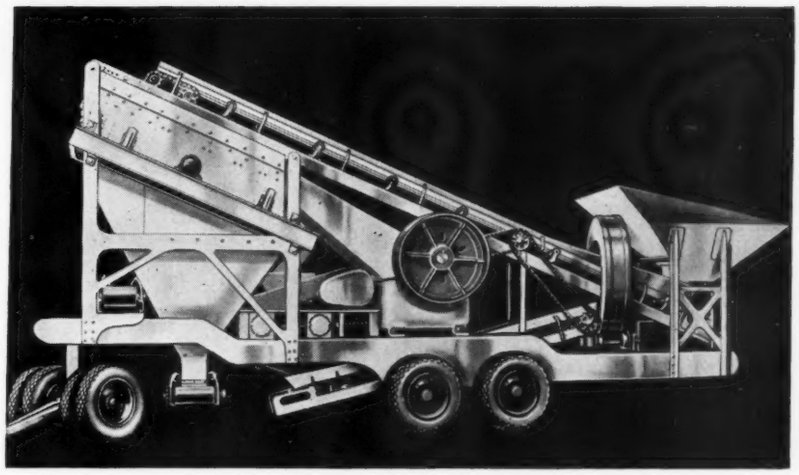
These units are designed to operate at pressures of 1# per square inch or less. Complete details are available from Pacific Flush Tank Co., 4241 Ravenswood Avenue.

## Le Tourneau Model P Carryall

R. G. LeTourneau, Inc., has recently perfected and introduced a new, single bucket scraper—the Model P Carryall. Light weight for capacity, new tailgate sheave arrangement, higher sides to retain the load, and a stronger yoke are features. Built with 11 yards struck capacity, 15 yd. heaped, with an 8′ 6" cutting blade,



Above: The Model P Le Tourneau Carryall Scraper. Right: The Davis combustible gas indicator is valuable in manholes and around sewage plants. Davis Emergency Equipment Co., 55 Van Dam St., N. Y.



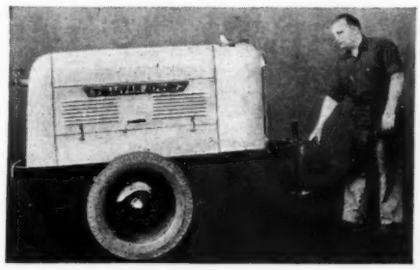
Universal dual crushing plant with rotavator.

## Rotavator Saves Space, Weight

Universal Crusher Company, Cedar Rapids, Iowa, has introduced a new model dual crushing plant in which the belt conveyor return system for feeding back material from both the primary jaw crusher and the secondary crushing rolls, has been replaced by a new turbine type revolving elevator called the Rotavator which conveys material discharged into it by the under crusher return conveyor to the screen feed conveyor directly above the latter.

The savings in weight and overall length and width that result from the use of the Rotavator provide a far lighter, more portable unit and shortens the cycle, speeding up production.

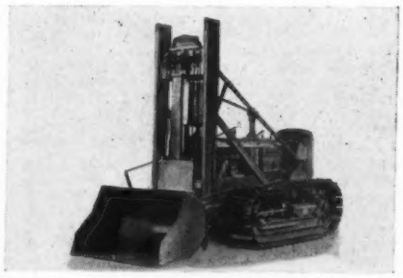
This plant is of welded construction, has 12 low pressure tires to meet state road regulations and requires only one operator.



The new Sullivan "Zeph-Air" compressors are light in weight and portable. Bulletin A-24 describes them. Sullivan Machinery Co., Michigan City, Ind.

## International T-35 Tractor Shovel

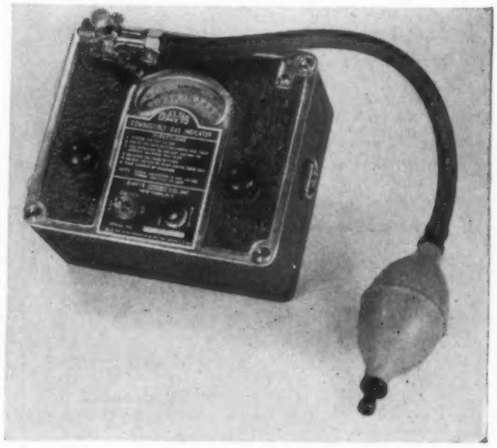
The Special-Modified International T-35 and TD-35 Tractor Shovel models are built around Special T-35 and TD-35 Tractors which have been modified especially for shovel service. This modification includes special long tracks,



Hough Tractor Shovel

six roller truck frames, spring loaded foot clutch, double steering clutches, reverse radiator fan, etc.

A new bulletin, No. P-114, just issued on the T-35 and TD-35 Tractor Shovels is available from Frank G. Hough Co., 919 N. Michigan Avenue, Chicago, Illinois.



# Readers' Service Department

These helpful booklets are FREE. Write to the firm whose name is given, mentioning PUBLIC WORKS, or to this magazine.

## Construction Materials and Equipment

**Air Compressor from Ford Parts**

5. How you can convert an ordinary Ford model A or B motor into an air compressor for operating jackhammers, paving breakers, clay spaders, tampers, paint sprays, etc., is explained in a new bulletin just issued by Gordon Smith & Co., Desk G, 516—10th St., Bowling Green, Ky.

**Cold Mix Plants**

10. New catalog and prices of Portable Bituminous Mixers in 6 to 14 ft. sizes for resurfacing and maintenance. Issued by The Jaeger Machine Co., 400 Dublin Ave., Columbus, Ohio.

**Concrete Accelerators**

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully subject suggested by title.

31. New 48-page booklet in five sections explains clearly the effects, advantages and methods of using Calcium Chloride with Portland Cement mixes. Complete and packed with practical information; well illustrated; pocket size. Sent free on request by Solvay Sales Corp., 40 Rector St., New York, N. Y.

36. "Wyandotte Calcium Chloride and its use in Portland Cement Concrete," a booklet covering the subject of curing concrete pavements, structures, etc., giving complete specifications for surface and integral curing. Published by the Michigan Alkali Co., 60 East 42d St., New York, N. Y.

**Dirt Moving Efficiency**

65. "Dirt Moving," is a new 32 page booklet illustrating the use of Trac Tractors as a source of money-making power for bulldozers, bullgraders, wheel scrapers, fresnos, graders, dump wagons, tampers, etc. 24 pages of action pictures, directions, etc. Sent promptly by Internaional Harvester Co., 180 No. Michigan Ave., Chicago, Ill.

**Drainage Products**

70. Standard corrugated pipe, perforated pipe and MULTI PLATE pipe and arches—for culverts, sewers, subdrains, cattlepasses and other uses are described in a 48-page catalog entitled "ARMCO Drainage Products," issued by the Armco Culvert Mfrs. Association, Middletown, Ohio, and its associated member companies. Ask for Catalog No. 12.

**Hose and Belting**

87. Complete information on rubber hose and belting for all types of contracting and road building service. The Government Sales Department of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

**Mud-Jack Method**

107. How the Mud-Jack Method for raising concrete curb, gutter, walls and street solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a new bulletin by Koehring Company, 3026 West Concordia Ave., Milwaukee, Wis.

**Paving Materials, Bituminous**

111. An excellent booklet issued by The Barrett Co., 40 Rector St., New York, N. Y., describes and illustrates the uses of each grade of Tarvia and Tarvialithic; 32 good illustations.

**Paving Materials, Gutters**

119. "Brick Gutters and Parking Strips." A study dealing with the problems faced in the proper construction of gutters and how they can be overcome.

*(Continued on page 47)*

### Two Folders on Dirt Moving

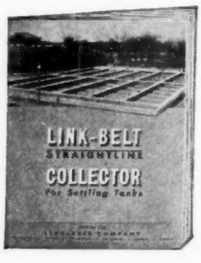
Modern, money-saving construction tools that handle jobs from the rugged start to the fine finishing are graphically pictured and accurately described in two new folders. The General Construction 12-page folder deals with the entire LeTourneau line, 'Dozers, Carryalls, Sheep's Foot Rollers, Rooters, Tractor Cranes, and Power Control Units. Job pictures illustrate LeTourneau effectiveness on different types of jobs and under varied job conditions. The County and Government folder pictures LeTourneau 'Dozers, Carryalls, and Rooters giving more miles of good roads and more improvements for the same tax dollar. Highway maintenance and construction jobs are shown handled from the initial cuts to the finished grade. Copies of these two publications may be obtained from any LeTourneau and Caterpillar dealer or by writing R. G. LeTourneau, Inc., Peoria, Illinois.

### Armco's New Pipe-Arch

Designed primarily for locations of low clearance or headroom, the Armco Pipe-Arch possesses high hydraulic efficiency in addition to retaining the advantages of standard corrugated metal pipe. The top and bottom of the Pipe-Arch are factory-riveted together into a single piece. Sections may be fastened together with standard couplings or connecting bands of the same shape.

Extensive dead-load and live-load tests show that the Pipe-Arch has strength closely comparable to that of standard corrugated pipe of equivalent span or diameter. This new product is available in spans ranging from 18 to 72 inches, with the rise being a little less than two-thirds the span. It is available in plain-galvanized or with bituminous paved invert. Principal uses are culverts under highways, railways, and street intersections; storm and sanitary sewers; and conduits for gas, water, steam, electric and other utility lines.

**How the Armco pipe arch is installed.**

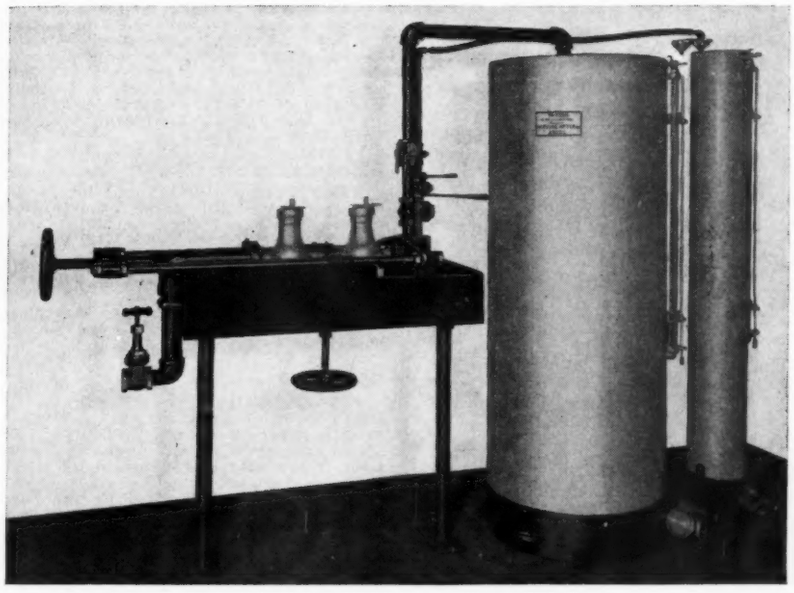



**The new Link-Belt Sludge Collector bulletin contains much valuable data on settling tank design. Sent on request.**

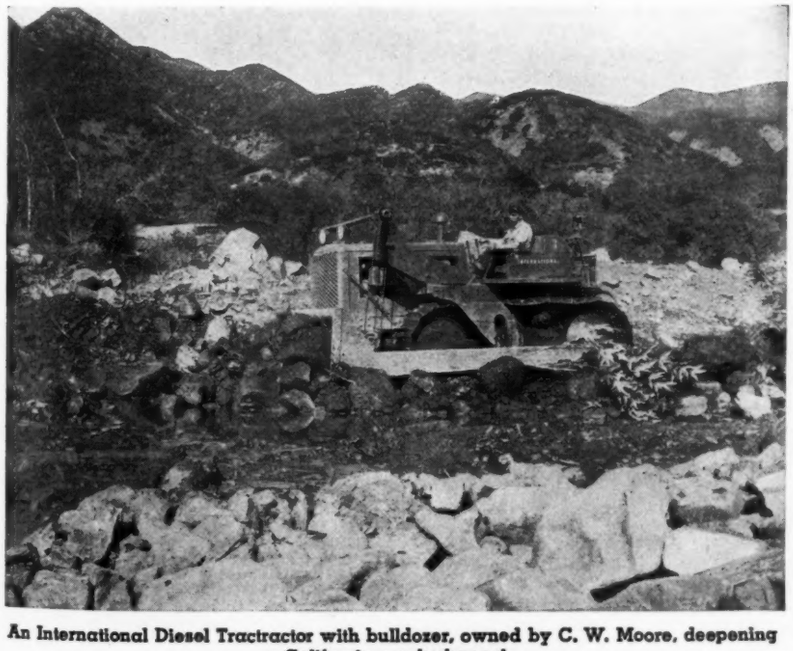
**The Lima "Paymaster" truck crane taking down New York's old 6th Ave. El.**

### Post Decimal Equivalent Chart

The Frederick Post Company has just released another "good-will builder" to be distributed free to engineering and architectural draftsmen. This is an 8" x 1¾" decal that contains all the usual decimal equivalents from 1/64 to 63/64ths. Sized to fit the T-square, the "decal" is easily transferred and will eliminate the usual squinting at the distant figures of a wall chart through the smoky murk of the busy office. A request to your nearest Post dealer or to The Frederick Post Company, Box 803, Chicago, Ill., will bring you the desired number of these new decimal equivalent "decals." They are FREE to all persons in the architectural, engineering or designing and drafting professions.



**Neptune meter testing set. Neptune Meter Co., 50 West 50th St., N. Y., will send full data.**



**An International Diesel Tractractor with bulldozer, owned by C. W. Moore, deepening a California creek channel.**

## Readers' Service Department

These helpful booklets are FREE. Write to the firm whose name is given, mentioning PUBLIC WORKS, or to this magazine.

*(Continued from page 46)*

Covers design, construction and results. Well illustrated. Just issued by the National Paving Brick Ass'n, National Press Building, Washington, D. C.

**Pumps**

121. New illustrated catalog and prices of Jaeger Sure Prime Pumps, 2" to 10" sizes, 7000 to 220,000 G.P.H. capacities, also Jetting, Caisson, Road Pumps, recently issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

123. New brochure by Gorman-Rupp Co., Mansfield, Ohio, illustrates and describes many of the pumps in their complete line. Covers heavy duty and standard duty self-priming centrifugals, jetting pumps, well point pumps, triplex road pumps and the lightweight pumps.

**Retaining Walls**

126. Charts showing the design of cellular or bin-type metal retaining walls, helpful suggestions on their use for stabilizing slopes, preventing stream encroachment, and solving problems of limited right of way, and construction details are given in a 16-page bulletin entitled, "ARMCO Bin-Type Retaining Walls." It is published by the Armco Mfrs. Association, Middletown, Ohio, and member companies. Ask for Bulletin H-37.

**Road Building and Maintenace**

127. See road work as it was done in the 1890's and as it can be done by a full line of this year's road building equipment. See, in this new action picture book, the first reversible roller, 1893 World's Fair Award Grader and how methods have changed. Attractive new booklet AD-1796 recently issued by The Austin-Western Road Machinery Co., Aurora, Ill.

128. Motor Patrol Graders for road maintenance, road widening and road building, a complete line offering choice of weight, power, final drive and special equipment to exactly fit the job. Action pictures and full details are in catalog 200 issued by Galion Iron Works & Mfg. Co., Galion, Ohio.

**Rollers**

130. New bulletin describing in detail the new Huber Road Rollers will be sent promptly on request by the Huber Mfg. Co., Marion, Ohio.

132. "The Buffalo-Springfield line of road rollers (tandem, 3-wheel, and 3-axle) are described in the latest catalog issued by the Buffalo-Springfield Roller Co., Springfield, Ohio."

133. New Tu-Ton roller of simple construction for use in rolling sidewalks along highways, playgrounds and other types of light rolling is fully described in a bulletin issued by C. H. & E. Mfg. Co., 3846 No. Palmer St., Milwaukee, Wis.

**Shovels, Cranes and Excavators**

145. The Austin-Western-Badger, a fully convertible ½ yard crawler shovel, made by The Austin-Western Road Machinery Co., No. A-5 Aurora, Ill., is fully described and illustrated in their Bulletin No. AD-1683.

146. New catalog picturing the detailed construction of Osgood "Chief" power shovel and illustrating it as shovel, clamshell, dragline, crane and piledriver. Write The Osgood Co., Marion, Ohio, for your copy.

**Soil Stabilization**

152. The Columbia Alkali Corporation, Barberton, Ohio, will be glad to furnish to anyone interested complete information dealing with Calcium Chloride Stabilized Roads. This literature contains many charts, tables and useful information and can be obtained by writing The Columbia Alkali Corporation, Barberton, Ohio.

*(Continued on page 48)*

# Readers' Service Department

*(Continued from page 47)*

154. "Soil Stabilization with Tarvia"—An illustrated booklet describing the steps in the stabilization of roadway soil with Tarvia will be mailed on request by The Barrett Company, 40 Rector St., New York, N. Y.

155. "Better Bases for Better Roads" is a useful new booklet describing and illustrating the use of calcium chloride stabilized graded aggregate mixtures for pavement bases. Sent on request by Solvay Sales Corp., 40 Rector St., New York, N. Y.

**Steel Forms**

160. Complimentary Bulletin S-19-F, issued by The Heltzel Steel Form and Iron Co., Warren, Ohio, contains complete information on the use of steel forms for constructing concrete curbs, curb and gutters and sidewalks.

**Trailers**

170. A fast loading and fast hauling trailer is illustrated and described in a 12-page folder by Meili-Blumberg Corp., New Holstein, Wis. The platform tilts for safe, easy, one-man operation. Initial cost is low, upkeep negligible, capacity up to 10 tons. Write Meili-Blumberg for folder.

## Street and Paving Maintenance

**Asphalt Heaters**

198. Illustrated Bulletins 15 to 20 describe Mohawk Oil Burning Torches; "Hotstuf" Tar and Asphalt Heaters; Portable Trailer Tool Boxes; Pouring Pots and other equipment for street and highway maintenance, roofing, pipe coating, water proofing, etc. Mohawk Asphalt Heater Co., Frankfort, N. Y.

**Dust Control**

210. "How to Maintain Roads with Dowflake" is a new 58 page illustrated booklet of information on stabilized road construction. Includes specifications and several pages of reference tables from an engineer's notebook. Issued by Dow Chemical Co., Midland, Mich.

**Sweepers, Rotary**

300. "Frink Roto-Broom," a 4 page bulletin illustrating and describing a new rotary sweeper by Frink. Attaches to front of and makes a sweeper of any motor truck. Used by street and highway departments, parks, airports, playgrounds, arenas, coliseums, etc., for sweeping dust, dirt, sand gravel, cinders, leaves or snow. Carl H. Frink, Mfr., Clayton, 1000 Islands, N. Y.

## Snow Fighting

**Plows**

349. "Frink V Type Sno-Plows" is a 24 page catalog fully illustrating and describing 8 models of V Type Sno-Plows for motor trucks from 1½ up to 10 tons capacity, 16 models of Frink Leveling Wings, the Frink Hand Hydraulic Control and the latest Frink Selective Power Hydraulic Control. Data are given for selecting the proper size V plow and wing for any truck. Issued by Carl H. Frink, Mfr., Clayton, 1000 Islands, N. Y.

## Sanitary Engineering

**Anaylsis of Water**

360. "Methods of Analyzing Water for Municipal and Industrial Use," is an excellent 94 page booklet with many useful tables and formulas. Sent on request by Solvay Sales Corp., 40 Rector St., New York, N. Y.

**HOW TO ORDER: These booklets are FREE. Write to the firm whose name is given, mentioning PUBLIC WORKS, or to this magazine.**

**Frank S. O'Neil has been appointed general manager of the Link-Belt Indianapolis plants.**

### Packaged Calcium Hypochlorite

A new handy sized package of calcium hypochlorite is now available through Proportioneers, Inc., Providence, R. I., for use by operators of small water plants, sanitarians, etc. This consists of a carton with full directions for use printed on the outside. It contains one 6 oz. bottle of HTH and one 6 oz. bottle of Perchloron. This 12 ounces is sufficient to treat 150,000 gallons of water with a dosage of 4 lbs. of $Cl_2$ per million gallons.

### Filter Wash Troughs:

Bulletin 950 describes wash troughs for gravity, filters and softeners. Discusses fundamentals of trough design and suggests spacing. International Filter Co., 325 W. 25th Place, Chicago, Ill.

### Safety of Travel:

This study of road vehicles has particular reference to comparisons in the performance of front, rear and four wheel drive vehicles. Covers tractive requirement, weight-speed relationships, grade climbing and ability on curves. 40 pages; mimeographed; technical. Four Wheel Drive, Clintonville, Wisc.

### Water Works Equipment:

H. W. Clark Co., Mattoon, Ill., have just issued a 96-page catalog covering meter boxes, valve casings, meter testers, meter yokes, service and valve boxes and municipal and special castings. Sent on request to home office or to Northrop & Co., 50 Church St., N. Y.

**The Marvel-Wyco gasoline engine driven concrete vibrator is made by Concrete Equipment Mfrs., 80 East Jackson Blvd., Chicago, Ill.**

# Readers' Service Department

**Activation and Aeration**

375. This concise folder No. 1294 describes "Straightline Aerators" for activated sludge treatment; combines these features: 1, rapid circulation in the tanks; 2, exposure of large surfaces, hastened oxidation and bacteriological growth. Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.

380. A valuable booklet on porous diffuser plates and tubes for sewage treatment plants. Covers permeability, porosity, pore size and pressure loss data, with curves. Also information on installations, with sketches and pictures, specifications, methods of cleaning and studies in permeability. 20pp. illustrated. Sent on request to Norton Company, Worcester, Mass.

**Aerators for Sewage**

381. New 24 page booklet, No. 6571 describes and illustrates the Dorrco Paddle Aerator and also the Turbo-Aerator. Also contains a discussion of the activated sludge method of treatment with much interesting data and illustrations, including a section of "Useful Information." Issued by The Dorr Co., 570 Lexington Ave., New York, N. Y.

**Automatic Controls**

382. Pressure and liquid levels controls will maintain water level in 50-ft. tank within 1 foot. Send for full information. Electric Controller & Mfg. Co., 2710 East 79th St., Cleveland, O.

**Cleaning Sewers**

383. Low cost, rapid and complete cleaning of sewers. Booklet on request. Champion Corp., Hammond, Ind.

**Cast Iron Sewers**

384. Cast Iron Pipe for Sewers. Cast Iron Pipe has beam strength, resistance to crushing stresses and infiltration-proof joints making it highly desirable for flow lines, force mains, submarine lines, outfalls and sewage treatment plants. For specifications write U. S. Pipe and Foundry Company, Burlington, N. J.

**Chemical Treatment**

385. A handbook on the application of chlorine and iron salts in sewerage treatment. Tech. Publication 177. Wallace & Tiernan Co., Inc., Newark, N. J.

**Diesel Engines**

386. Write Dept. 118, Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago, Ill., for data on how the installation of F-M diesels has lowered taxes and made it possible for many communitines to pay for their improvements out of municipal power plant earnings.

**Feeders, Chlorine, Amonia and Chemical**

387. For chlorinating water supplies, sewage plants, swimming pools and feeding practically any chemical used in sanitation treatment of water and sewage. Flow of water controls dosage of chemical; reagent feed is immediately adjustable. Starts and stops automatically. Literature from %Proportioneers, Inc.% 96 Codding St., Providence, R. I.

388. Chemical Feed Machines. Description, principles of operation; data on installation. E. W. Bacharach & Co., Rialto Building, Kansas City, Mo.

**Filter Plant Controllers**

389. "The Modern Filter Plant" and the uses of Simplex Controllers for operation are described in a handy, 16-page booklet. Charts, data, curves and tables. Simplex Valve and Meter Co., 68th and Upland Sts., Philadelphia, Pa.

**Flow Meters**

391. The primary devices for flow measurement—the orifice, the pilot tube, the venturi meter and others—and the application to them of the Simplex meter are described in a useful 24-page booklet (42A). Simplex Valve and Meter Co., 68th and Upland Sts., Philadelphia, Pa.

*(Continued on page 49)*

# Readers' Service Department

*(Continued from page 48)*

**Garbage Incineration**

392. Send for full information about the Decarie Suspended Basket-Grate Garbage Incinerator which solves the garbage disposal problem of any city economically and with a minimum of space. Nichols Engineering and Research Corp., 60 Wall Tower, New York, N. Y.

**Manhole Covers and Inlets**

404. Street, sewer and water castings made of wear-resisting chilled iron in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter, crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., South Bend, Ind.

**Pipe, Concrete**

409. Two excellent booklets, 12 and 16 pps., describe manufacture and installation of reinforced concrete pipe for gravity and pressure lines for sewage and storm drainage. Lock Joint Pipe Co., Ampere, N. J.

**Pipe Forms**

411. Making concrete pipe on the job to give employment at home is the subject of a new booklet just issued by Quinn Wire and Iron Works, 1621 Twelfth St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms. Sent promptly on request.

**Pipe Joints, Sewer**

415. How to make a perfect sewer pipe joint—tight, prevents roots entering sewer, keeps lengths perfectly aligned; can be laid with water in trench or pipe. General instructions issued by L. A. Weston, Adams, Mass.

**Pumps and Well Water Systems**

420. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for descriptive booklets. Layne & Bowler, Inc., Dept. W, General Office, Memphis, Tenn.

**Pumping Engines**

424. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

**Rustproofing, Electric**

427. No painting costs. Current from special electrodes removes all corrosion and prevents rusting. Informative literature on request. Electro Rustproofing Co., 38 N. Jefferson St., Dayton, Ohio.

**Screens, Sewage**

428. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straight-line Bar Screens" (Vertical and Inclined types). Link-Belt Co., 307 N. Michigan Avenue, Chicago Ill.

**Meter Setting and Testing**

430. All about setting and testing equipment for Water Meters—a beautifully printed and illustrated 40 page booklet giving full details concerning Ford setting and testing apparatus for all climates. Ford Meter Box Co. Wabash, Ind.

**Small Septic Tanks**

438. Septic Disposal Systems, Waterless Toilets, Multiple Toilets for Camps and Resorts, and other products for providing safer sewage disposal for unsewered areas are described and illustrated in data sheets issued by San-Equip Inc., 700 Brighton Ave., Syracuse, N. Y.

**Sludge Drying and Incineration**

439. The five basic steps of: sludge preparation; flash drying; incineration; deodorization; and dust collection are explained in a new 24 page booklet, No. 6781 issued by The Dorr Company, 570 Lexington Ave., New York, N. Y., sales representatives for the C-E Raymond system of sludge drying and incineration.

# Association Meetings

The Central States Sewage Works Association will meet at the Congress Hotel, Chicago, Oct. 12 and 13. W. H. Wisley, Springfield, Ill. is secretary.

The American Road Builders Association Convention and Road Show will be held at Chicago, Ill., January 29 to Feb. 2. Convention sessions and show will be held at the International Amphitheater.

The New England Sewage Works Association will hold its Fall meeting at the Toy Town Tavern, Winchendon, Mass., Sept. 29 and 30. L. W. Van Kleeck, Hartford, Conn., is secretary.

The American Water Works Association will hold its 1940 convention at Kansas City, Mo., April 21 to 25. All technical sessions and exhibits will be held in the Auditorium. Harry E. Jordan, 22 East 40th St., N. Y., is secretary.

The California Sewage Works Ass'n. will hold its 12th Annual convention in Oakland, Calif., Sept. 18 and 19. R. R. Ribal, 701 City Hall, Oakland, is secretary.

North Carolina Section, AWWA, will hold its annual section meeting at Hotel Charlotte, Charlotte, N. C., Nov. 6-8. W. M. Franklin, Charlotte, N. C., is in charge of local arrangements.

The 1939 meeting of the Virginia section of the American Water Works Association will be held at the University of Virginia, Charlottesville, Va., Sept. 7 and 8. H. W. Snidow, 119 State Office Bldg., Richmond, Va., is secretary.

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The administrative and sales offices of International Filter Co. were moved June 2 from Chicago's loop district to the company's factory at 325 W. 25th Place, Chicago. This move was made, according to P. N. Engel, president, more effectively to coordinate work of the administrative, sales, engineering and production departments.

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The Roots-Connersville Blower Corp. has moved its Chicago office from Room 814, 140 South Dearborn Street, to Room 1027, People's Gas Building, 122 So. Michigan Avenue.

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## POSITION WANTED:

Chemist-bacteriologist, recently employed on water supply, desires position in either sewage or water work. Has had experience in both fields. Holds B.S. degree, C.C.N.Y., 1933. Reserve officer, sanitary corps. Will go anywhere. Excellent references, AJK, c/o Public Works, 310 East 45th St., N. Y.

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# Readers' Service Department

440. Disposal of Municipal Refuse: Planning a disposal system; specifications. The production of refuse, weights, volume, characteristics. Fuel requirements for incineration. Also detailed outline of factors involved in preparation of plans and specifications. Morse-Boulger Destructor Co., 216P East 45th St., N. Y.

444. A new booklet "Essential Factors in the Design and Layout of Swimming Pool Systems," with data on filtration equipment, fittings, solution feeders, accessories, etc., is available from Everson Manufacturing Co., 213 West Huron St., Chicago, Ill.

445. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

446. 40-page Manual on swimming pools. Includes swimming and pool layouts, specifications, etc., and details concerning Permutit Swimming Pool Equipment. Write The Permutit Co., Dept. G-4, 330 West 42 St., New York, N. Y.

447. "Painting Swimming Pools," an interesting booklet by Dr. A. F. Pistor, covers the subject thoroughly, discussing objectively the relative merits of the different types of coatings recommended for that purpose. Write Inertol Co., 401 Broadway, New York, N. Y.

**Taste and Odor Control**

448. How, when, and where activated carbon can and should be used to remove all kinds of tastes and odors from water supplies is told in a booklet issued by Industrial Chemical Sales Div., 230 Park Ave., New York, N. Y. 77 pages, tables, illustrations and usable data.

**Treatment**

450. "Safe Sanitation for a Nation," an interesting booklet containing thumbnail descriptions of the different pieces of P.F.T. equipment for sewage treatment. Includes photos of various installations and complete list of literature available from this company. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill.

453. New booklet (No. 1642) on Link-Belt Circuline Collectors for Settling Tanks contains excellent pictures; drawings of installations, sanitary engineering data and design details. Link-Belt Company, 2045 W. Hunting Park Ave., Philadelphia.

460. This new 145 page illustrated chemical products book contains 55 pages of Tables, Factors and valuable Reference Data. Issued by General Chemical Co., 40 Rector St., New York, N. Y.

461. Ferrisul for Water and Sewage Treatment. Handy booklet describing Ferrisul and telling how it is used. Merrimac Chemical Div., Everett Station, Boston, Mass.

**Valves and Hydrants**

470. Complete booklet with much worthwhile water works data describes fully Ludlow hydrants and valves. Sent on request. Ludlow Valve Mfg. Co., Troy, N. Y.

**Water Works Operating Practices**

490. "Important Factors in Coagulation" is an excellent review with bibliography and outlines of latest work done in the field. Written by Burton W. Graham and sent free on request to Activated Alum Corp., Curtis Bay, Baltimore, Md.

## HOW TO ORDER

**To obtain any of these booklets without obligation, send a post card to the firm whose name and address are given in the description and MENTION PUBLIC WORKS MAGAZINE. Or, if you prefer, send your request to Readers' Service Dept., PUBLIC WORKS, 304 East 45th St., New York, N. Y.**

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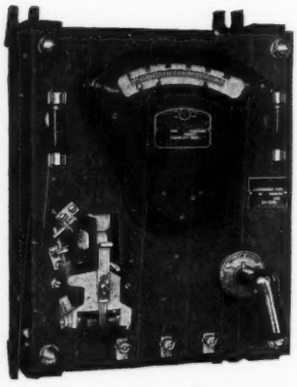
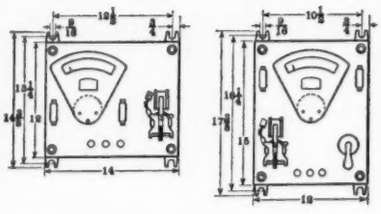


*Form C Altitude Regulator*



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The low and high contacts of the Altitude Regulator may be set at a minimum distance apart of 2% of the scale length or any distance up to a maximum of 100%. Altitude Gauges can be furnished for pressures from 0 to 10 pounds up to 0 to 1500 pounds. Scales are calibrated to indicate ounces, pounds, feet of water or any units desired.

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## For the Engineer's Library

**Brief reviews of the latest books, booklets and catalogs for the public works engineer.**

### Conical Plug Valves:

This is a summation of the findings, developments and available data pertinent to the use of rotovalves, which are particularly adapted to use as stop, altitude, float operated, automatic check, free discharge, pressure relief, pressure reducing, reseating throttle and emergency line check valves. This book of 96 pages should be of very great value to the engineer, as it contains much data helpful in design. We believe it will be sent on request, but better use your letter-head. S. Morgan Smith Co., York, Pa.

### Water Hammer:

Here is an excellent little booklet on water hammer. It is written around the use of the Wacor water hammer arrester, but contains much of value to the waterworks superintendent, including charts showing water hammer pressure possible, data on the problem, and sample installation pictures. For booklet, write Water Hammer Arrester Corp., Milwaukee, Wisc.

### Testing for Leaks:

The full title of this booklet is "The Vibration Differentiation Method of Testing Pipe Lines for Leaks." It gives full and worth while information on this newer method, which is based on the fact that water, gas, steam, etc., escaping under pressure causes vibrations. Western Instrument Co., 5115 Kinsie St., Los Angeles, Calif.

### Water Treatment with Carbon:

An excellent 48-page booklet on the use of activated carbon in removing tastes and odors from water. Uses of both powdered and granular filters are covered in an excellent manner, and considerable space is devoted to descriptions of tests and their application to plant control. L. A. Salomon & Bro., 216 Pearl St., New York.

### Power Cost Record Book:

International Harvester has developed a simple industrial power cost record book that enables the tractor and power unit owner to obtain without much extra labor an accurate and comprehensive statistical picture of how his power equipment is operating and how much each tractor and each stationary engine is costing. For use with this book a printed form to be filled in daily by the tractor or engine operator has also been devised, and both these drivers' daily report forms and cost books are available free of charge to owners whether they operate International equipment or not. International Harvester Co., 180 No. Michigan Ave., Chicago, Ill.

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